PETERSEN

INSTRUCTION MANUAL

MODEL 1045

RF POWER METER
MODEL 1045

PM PACIFIC MEASUREMENTS INCORPORATED

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REPLACEABLE PARTS LIST

CIRCUIT REFERENCE	PART NUMBER	DESCRIPTION
J1	----------	Part of W1, BCD Cable Assy 1428
A14C1	10000-3	Ceramic 470 pF ±20% 1000V
A14C2	10787-6	Tantalum 2.7 µF ±20% 15 VDC
A14C3	10787-4	Tantalum 68 µF ±20% 15 VDC
A14C4	10000-10	Ceramic 0.1 µF ±20% 100V
A14C5	10000-10	Ceramic 0.1 µF ±20% 100V
A14C6	10000-10	Ceramic 0.1 µF ±20% 100V
A14J1	10978-3	Receptacle, 24 pins
A14R1	10013-49	Carbon Film 100KΩ ±5% 1/4W
A14R2	10013-57	Carbon Film 10KΩ ±5% 1/4W
A14R3	10013-53	Carbon Film 220KΩ ±5% 1/4W
A14U1	13470-1	Integrated Ckt SN74LS00
A14U2	13470-4	Integrated Ckt SN74LS04
A14U3	13470-17	Integrated Ckt SN74LS123
A14U4	13470-38	Integrated Ckt SN74LS367
A14U5	13470-38	Integrated Ckt SN74LS367
A14U6	13470-38	Integrated Ckt SN74LS367

SPECIFICATIONS

Logic levels:	
One	2.4 V at 0.5 mA
Zero	0.4 V sinking 8 mA (Standard TTL logic.)
Data Format:	A logical one implies true data. A logical one implies + polarity. A transition to a logical one occurs when new data becomes ready. When the display is collecting new data a zero is output on the "Data Ready" line.
Conversion Period:	Data will have been collected and the "Data Ready" line will become true less than 1.5 ms after the display has been triggered.
Trigger:	If the interface is used to trigger the instrument, the instrument will take no data as long as a "zero" is supplied to the Trigger line. When a positive transition occurs, data will be taken.
Pulse Width	1.0 µs minimum. 0.1 s maximum.
Connector:	24 Pin Amphenol #57-40240
Mating Connector:	24 Pin Amphenol #57-30240.

ACCESSORY

A mating connector for the Input/Output connector is supplied, Pacific Measurements' part number 1060-10757.

MODIFICATION

The BCD Interface Board Assembly 14266 has been installed in the upper left hand location in the instrument. Connection to the rear panel connector is made by a ribbon cable terminated in a 24 pin integrated circuit type connector mating with a socket on the board. Machine screws fasten the rear connector and its associated spring clips to the rear panel.

OPERATING INFORMATION

DATA OUTPUT

Data is output in true format, refer to the connector pin list for the signals output. The data from the display is formatted in standard BCD. The decimal location is output as follows:

SUPPLEMENTARY DATA

BCD INTERFACE FOR MODEL 1045, OPTION 04

This instrument is equipped to provide data from the display in Binary Coded Decimal (BCD) format at a rear panel connector. The following signals appear on the terminals of the 24 pin connector:

Pin Number	Signal (Defined true)
1	Plus Sign
2	"40"
3	"20"
4	"10"
5	"8"
6	"4"
7	"2"
8	"1"
9	Decimal "1"
10	Decimal "2"
11	Trigger Input
12	Shield (Chassis)
13	".8"
14	".4"
15	".2"
16	".1"
17	".08"
18	".04"
19	".02"
20	".01"
21	Range "1"
22	Range "2"
23	Data Ready
24	Logic Common

Display	Decimal "1" & "2"	
	Binary	Decimal
.NNNN	00	0
N.NNN	01	1
NN.NN	10	2

Note that this can be thought of as the format .NNNN $X10^{D}$ where D=Decimal representation of Decimal "1" and "2" lines. The range corresponding to the annunciators to the right of the display is output as follows:

Range	Binary "2","1"	Range "1" and "2" Decimal
dB	00	0
µW	01	1
mW	10	2
W	11	3

The "Data Ready" line indicates when new data has become available. It drops to a logic zero whenever the display starts a conversion and returns to a logic one when the conversion has finished and the new data is on the data lines. The period for conversion varies, depending upon when a trigger is received relative to the internal clock used to start a conversion, but it will not exceed 1.5 ms. nor be less than 0.3 ms. You are recommended to use the rising edge of the "Data Ready" signal to actuate a device connected to the interface.

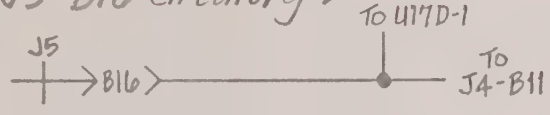
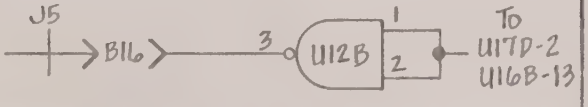
TRIGGERING

If pin 11 of the Interface Connector is left unconnected or supplied with a steady "One", the instrument will trigger in the normal way. That is, approximately four times per second on Internal Trigger, or if the rear switch is set to "External", whenever a trigger is received at the rear panel BNC Trigger connector.

Alternatively, pin 11 can be used to supply the trigger. When a "zero" is supplied the instrument will be inhibited from triggering in the normal way just described. When a transition from a zero to a one occurs, the instrument will trigger. The trigger signal must stay a one for at least 1 µs but not longer than 0.1 s. Repetition rate must be below 500 Hz.

The instrument will trigger internally at the four Hertz rate even if triggering is inhibited on the CAL or COARSE ZERO modes.

MODEL 1045
MANUAL CORRECTIONS

CODE NO.	CORRECTION	PM PART NO.	SECTION OF MANUAL AFFECTED
02,03	CHASSIS		
	1) Change Variable Resistor from R2 and R3 Concentric Multi-Turn 20KΩ/ 10KΩ (14198) to R2 Multi-Turn 50KΩ	13076	8,9
02	CONTROL BOARD		
	1) Change A1U2 from SN74LS00N (#13470-1) to SN74LS10N	13460-6	8,9
	a.) Change A1U2A pins 3 and 4 to A1U2A pin 4	———	8
	b) Change A1U2B pin 2 and 13 to A1U2A pin 2.	———	8
	c) Change A1U2B pin 12 to A1U2B pin 3.	———	8
	d) Change A1U2C pin 8 to A1U2C pin 11.	———	8
	e) Change A1U2C pin 10 to A1U2C pin 12.	———	8
	f) Change A1U2C pin 11 to A1U2C pin 13.	———	8
	g) Remove A1U2C pin 9.	———	8
	h) Change J5-B16 circuitry:	———	8
	from 		
	to 		
	2) Change A1R54 from 18.16KΩ (12449-64) to 17.90KΩ	12449-61	8,9
	3) Remove A1R55 470KΩ (10013-57)	———	8,9
	4) Change A1R83 from Variable 50KΩ (10046-3) to Metal Film 499KΩ	10015-45	8,9

NUM	REVISION	ECO	DATE

J1
INTERFACE
INPUT / OUTPUT

12	O	1	+
11	BR	2	40
10	W	3	20
9	P	4	10
8	GN	5	8
7	O	6	4
6	BR	7	2
5	W	8	1
13	Y	13	.8
14	P	14	.4
15	BR	15	.2
16	GN	16	.1
17	BL	17	.08
18	Y	18	.04
19	R	19	.02
20	BK	20	.01
4	P	9	DEC 1
3	GN	10	DEC 2
21	GY	21	RANGE 1
22	BL	22	RANGE 2
23	Y	23	DATA READY
2	O	11	TRIGGER IN
24	R	24	COMMON
		12	CHASSIS

J2
B11
B12
B13
B16
B5
B14
B15
B20
B19
B7
B8
B9
B10
B6
A1
5V COM

J3
B1
B2
B3
B4
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20
A21
A22
A23
A24

U1A U1B U1C U1D
U2A U2B U2C U2D U2E U2F
U3A U3B
U4 U5 U6
U4A U4B U4C U4D U4E U4F
U5A U5B U5C U5D U5E U5F
U6A U6B U6C U6D U6E U6F

R1 47 Ω
R2 220K
R3 220K
C1 47 μF
C2 27
C3 .1 μF

J2
B8 REMS
B10 GET

ASSEMBLY 14266
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A14.

NOTE:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS AND ARE ±5%, ¼ W. CAPACITOR VALUES ARE IN MICROFARADS.

REF DESIG	TYPE
U4, U5, U6	SN74LS367N
U3	SN74LS123N
U2	SN74LS04N
U1	SN74LS00N

LIST OF MATERIAL

FINISH OR TREATMENT

UNLESS OTHERWISE INDICATED DIMENSIONS ARE IN INCHES
TOLERANCE
.XX ± .015
.XXX ± .005

DAN WATSON

PACIFIC MEASUREMENTS INCORPORATED

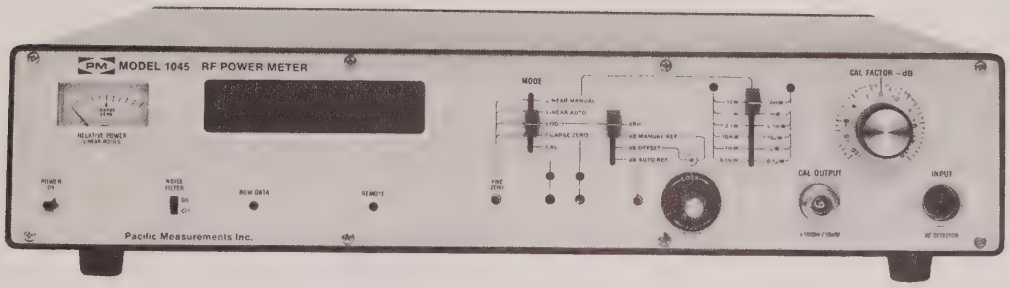
BCD INTERFACE

DRAWING NO 14267

SHEET 1 OF 1

NEXT ASSY

INSTRUCTION MANUAL



RF POWER METER

MODEL 1045

SERIAL NUMBER _____

PM

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PACIFIC MEASUREMENTS INCORPORATED

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CERTIFICATION

PACIFIC MEASUREMENTS INC. ("PM") certifies that this instrument was thoroughly tested and inspected and found to meet all its published specifications when it was shipped from the factory. PM further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

ONE YEAR LIMITED WARRANTY

PACIFIC MEASUREMENTS INC. ("PM") warrants to the original purchaser, and only the original purchaser, that this instrument will be free from defects in material and workmanship, under normal recommended use and operating conditions, for a period of one year after the date of delivery to the original purchaser.

PM's obligation under this Warranty is limited to (1) repairing or replacing, at PM's option, any part or parts (excluding RF diodes, RF connectors, batteries, and fuses) which are returned to PM in the manner specified below and which, upon inspection by PM's personnel, are determined to be defective as described above; and (2) calibrating the repaired instrument to current published specifications. If it is determined that the instrument is not defective, a nominal inspection charge will be charged and the instrument will be returned with transportation charges collect. If it is determined that the defect has been caused by misuse and/or abnormal operating conditions or that the instrument is not under Warranty, an estimate will be submitted prior to the commencement of necessary repair and calibration work. If the purchaser does not authorize PM to commence such repairs within fifteen days after such estimate is submitted, the instrument will be returned to the purchaser transportation charges collect.

PM'S OBLIGATION TO REPAIR OR REPLACE DEFECTIVE PARTS, AS DESCRIBED ABOVE, SHALL BE THE PURCHASER'S EXCLUSIVE REMEDY AND NO OTHER REMEDY SHALL BE AVAILABLE (INCLUDING, BUT NOT LIMITED TO, INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR LOST PROFITS, LOST SALES, OTHER ECONOMIC LOSS, INJURY TO PERSON OR PROPERTY, OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS SUSTAINED BY THE ORIGINAL PURCHASER OR ANY OTHER PERSON).

THE WARRANTY DESCRIBED ABOVE IS THE ONLY WARRANTY APPLICABLE TO THIS PM INSTRUMENT AND IS MADE EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR INFRINGEMENT.

WARRANTY PROCEDURE AND SHIPPING INSTRUCTIONS

If any fault develops, the following steps should be taken:

a. Notify PM immediately, giving model number, serial or part number, code number, and a detailed description of the nature and/or conditions of failure. On receipt of this information, service, operating, or shipping instructions will be supplied to you.

b. On receipt of shipping instructions, ship the instrument transportation prepaid to PM. The instrument should be shipped in the original shipping carton or, if damaged or not available, in a suitable rigid container with the instrument wrapped in paper or plastic and surrounded with at least four inches or cushioning material on all sides. If under Warranty, the instrument will be repaired and returned transportation prepaid.

RECEIVING INSTRUCTIONS

The instrument must be thoroughly inspected immediately upon receipt. All material in the shipping container should be checked against the enclosed packing list. PM will not be responsible for shortages against the packing list unless notified immediately. Upon receipt of shipment, if there is any visible evidence of damages, make a notation on the way bill of such damage and immediately contact the nearest office of the carrier in your city. If there is evidence of damage after the goods are unpacked, contact the nearest office of the carrier, request an inspection, and save all packing and materials therein until the inspection has been completed. A full report of the damage should be obtained by the carrier's claim agent, and a copy of this report forwarded to PM. Upon receipt of this report, you will be advised of the disposition of the equipment for repair or replacement. PM shall have no responsibility for damaged instruments if the above inspection requirements are not complied with. Time is of the essence regarding the above instructions.

TABLE OF CONTENTS

		Page Number
Section 1	GENERAL INFORMATION	
	1.1 The Pacific Measurements Model 1045 RF Power Meter	1-1
	1.2 Power Detector Units	1-2
	1.3 Options	1-2
	1.4 Performance Specifications	1-3
	1.5 Accessories	1-6
Section 2	INITIAL INSTRUCTIONS	
	2.1 Receiving Inspection	2-1
	2.2 Power Requirements	2-1
	2.3 Chassis Grounding	2-1
	2.4 Returning the Instrument	2-1
	2.5 Accessories	2-1
Section 3	OPERATION	
	3.1 Controls, Connections and Indicators	3-1
	3.2 List of Front Panel Features	3-1
	3.3 List of Rear Panel Features	3-2
	3.4 Operating Procedure	3-2
	3.5 Set Up for Operation Via the IEEE Bus (Option 05)	3-3
Section 4	PERFORMANCE CHECKS	
	4.1 General	4-1
	4.2 Equipment Required for Performance Evaluation	4-1
	4.3 Performance Tests	4-1
Section 5	CIRCUIT DESCRIPTION	
	5.1 Introduction	5-1
	5.2 The Model 1045 Block Diagram	5-1
	5.3 The Control Board	5-2
	5.4 Analog Board	5-3
	5.5 Display Logic and Calibrator	5-6
	5.6 Front Panel Control and Display Logic	5-7
	5.7 Detector Multiplexer Option	5-8
	5.8 Multi-Detector Board, Option 01	5-8
Section 6	MAINTENANCE	
	6.1 Periodic Maintenance	6-1
	6.2 Internal Adjustments and Test Points	6-1
	6.3 Calibration	6-2
	6.4 Trouble Shooting	6-5
	6.5 Semiconductor Devices	6-5
	6.6 Access to Internal Components	6-5
Section 7	INTERFACE BUS, OPTION 05 (IEEE 488-1975)	
	7.1 Controlling the Model 1045 from a Remote Location	7-1
	7.2 Programming the Functions with the Instrument as a Listener	7-1
	7.3 Fetching Data from the Instrument as a Talker	7-2
	7.4 Model 1045 Measuring and Transmitting Speed	7-2
	7.5 Serial Poll	7-2
	7.6 Example of Interactive Program for 1045 Programming	7-2
	7.7 HP 9825 Program	7-3
	7.8 Tek 4051 Program	7-3
	7.9 HP 9825 Program on Serial Poll	7-4
	7.10 Tek 4051 Program on Serial Poll	7-4

(Continued)

TABLE OF CONTENTS (Continued)

Section 8 BLOCK AND SCHEMATIC DIAGRAMS

Section 9 REPLACEABLE PARTS LIST

Section 10 MANUAL CORRECTIONS

SECTION 1

GENERAL INFORMATION

1.1 THE PACIFIC MEASUREMENT MODEL 1045 RF POWER METER

The Model 1045 RF Power Meter and RF Power Detector measure the RF power incident on a detector from 100 MHz to 18 GHz. There is an option of one detector input, or up to four detector inputs may be connected to the instrument, one selected for measurement at any time. The Model 1045 may be controlled from the front panel, or, with the addition of an interface board designed for an IEEE bus it may be remotely controlled, and transmit data to a remote terminal or calculator. Up to four sources can be measured remotely; remote control, when enabled, overrides local control from the front panel.

The Model 1045 has the following modes of operation:

a. LINEAR MANUAL MODE, where one of six ranges are selected from 10 Watts to 0.1 microwatts by the operator, locally or remotely.

b. LINEAR AUTO MODE, where the optimum power range is selected by the Model 1045 internal circuits.

c. LOG MODE, where the measurement may be in dB or dBm, selected locally or remotely by the operator, with a range of +10 to -50 dB or dBm with low power detectors, or +40 to -20 dB or dBm with high power detectors.

d. dB AUTO MODE, where any input level can be stored and used as the zero reference for other measurements. This is particularly useful where a comparison of the four inputs is required.

The RF power meter automatically detects the presence of a 30 dB pad in the detector.

A calibration factor control allows the sensitivity of the instrument to be set for variations in detector calibration factors. The calibration factor setting is obtained from a chart on the detector and compensates for variations due to frequency.

There is a small variation in the detected level due to temperature. The detector is equipped with a temperature sensor which compensates for this effect, but there may be some small residual variation. To compensate for this a test signal is available from the CAL OUTPUT connection on the front panel to enable the detected level to be adjusted precisely. The test signal is very stable with respect to temperature variations, has low harmonic output and is matched to 50 ohms exactly. This adjustment is required only in the linear mode and dBm mode.

A noise filter may be switched in, locally or remotely, which stabilizes the digital display

TABLE 1-1

DETECTORS AVAILABLE WITH THE MODEL 1045

PART #	CONNECTOR	POWER RANGE	FREQUENCY RANGE	RETURN LOSS		
				To 2 GHz	To 12 GHz	Above 12 GHz
13785	N plug	-50 dBm to +10 dBm	1 MHz to 14 GHz	25 dB	18 dB	16 dB
13786	N plug	-50 dBm to +10 dBm	1 MHz to 18 GHz	25 dB	18 dB	14 dB
13787	APC-7	-50 dBm to +10 dBm	1 MHz to 18 GHz	25 dB	18 dB	14 dB
13838	N plug	-20 dBm to +40 dBm	1 MHz to 14 GHz	25 dB	18 dB	16 dB
13839	N plug	-50 dBm to +10 dBm	0.1 MHz to 2 GHz	20 dB	-	-
13840	APC-3.5*	-50 dBm to +10 dBm	1 MHz to 18 GHz	25 dB	18 dB	14 dB
14139	N plug	-20 dBm to +40 dBm	1 MHz to 18 GHz	25 dB	18 dB	14 dB

*Compatible with SMA connectors

at low level measurements.

There is a control (dB MANUAL REF) allowing the RF reference level to be set to any level manually. When an oscilloscope is connected to the output, the output can be offset with the dB OFFSET control from the original reference level to set a particular point on the swept trace to zero. The offset required to do this is shown on the digital display on the front panel.

The RATIO/MARKER INPUT adds two features to the Model 1045. An input from a sweep generator can put a marker on the trace at a preselected frequency. The RATIO/MARKER INPUT can also be used for a reference input from another RF Power Meter. The detector input is read against this reference, and the output is the difference between the reference and detector inputs.

Other controls and indicator lamps for minor functions are fully explained in the operating section.

The measurements made may be seen on the front panel, or transmitted to a remote terminal via an IEEE bus. In addition, the Model 1045 can display a 60 dB dynamic range on a conventional oscilloscope; the display is linear in dB. If slower sweep speeds are used, the same output may be used to produce a permanent record on a plotter.

The instrument operates from a line source of 100-240 Vac, at a frequency of 50-400 Hz. The instrument may be turned on or off only at the front panel.

1.2 POWER DETECTOR UNITS

A range of power detectors are available, all are 50 ohm input impedance. They should be selected for use depending on the power range and frequency to be measured. Table 1-1 gives the detectors available, their power and frequency range and the PMI part number. Maximum input power (peak or average) before burnout is +23 dBm (200 mW). A 1.5 meter (5 foot) detector cable is included with the Model 1045.

1.3 OPTIONS

There are six options available, as shown in Table 1-2.

TABLE 1-2

OPTIONS AVAILABLE WITH THE MODEL 1045

OPTION 01	Four RF input connectors, selectable.
OPTION 02	APC-7 connector at the CAL OUTPUT. Compatible with the APC-3.5 connector on detector 13840, but does not include coupling nut.
OPTION 03	APC-3.5 female connector at the CAL OUTPUT.
OPTION 04	BCD data output.
OPTION 05	IEEE STD 488-1975 interface bus.
OPTION 06	Single detector input and CAL OUTPUT on rear panel only.

Option 01 allows up to four detectors to be connected to the rear of the instrument. The detector is selected by a front panel power-position switch, or by remote control if option 05 is also included. Detector inputs and calibrator output are on the rear panel.

Option 02 and 03 include a connection option to the CAL OUTPUT which provides a connector compatible with any detector.

Option 04 provides a BCD output via the INTERFACE INPUT-OUTPUT connector on the rear panel. Logic levels are TTL compatible with positive true logic.

Option 05 has an IEEE STD 488-1975 bus interface, which provides a complete input and output control and data interface to a remote controller or calculator. The bus connection is via the INTERFACE INPUT-OUTPUT connector on the rear panel.

The instrument responds to commands which address it as a Talker, or a Listener, or require it to trigger. It is able to issue a Service Request, and participate in a Serial Poll. When remote control is called for, the controls on the front panel are inactive. The user has the option of retaining the function of the CAL FACTOR control during remote operation by making an internal switch selection.

When active as a listener, the instrument will accept data which selects its function and range. One data byte selects its function, another selects the detector (if Option 01 is included in the instrument) and a third supplies a trigger. (Alternatively, the Group Execute Trigger bus function can be used.) Thus, only three bytes are needed to completely control the instrument and cause it to take a reading. As soon as it has data it will issue a Service Request; then, when addressed as a talker it will respond to the serial poll and when an active talker, send the measured data automatically. Eleven bytes of data are output. The last two bytes are for the Carriage Return and Line Feed. All data are defined according to the American Standard Code for Information Interchange (ASCII).

Inside the instrument on the interface board are two sets of switches. One group of five selects the listener address and another group of five selects the talker address as shown in Paragraph 3.5. In order to allow some flexibility in the way the instrument is used under program control, four additional switches allow the following capabilities: The Service Request feature can be disabled. The trigger function can be set to be from the bus, from an external source or internal to the instrument. The front panel CAL FACTOR switch can be made active even under remote control. Finally, the instrument can be set for Talk Only operation. When set in the Talk Only mode, the instrument outputs data as it becomes available. This is useful when driving just one peripheral device, such as a printer.

The instrument is capable of making up to 500 measurements per second. Data can be transmitted on the bus at 200K bytes per second if the listener/controllers on the bus can accept data at that rate.

Option 06 has the single detector INPUT and CAL OUTPUT connectors located on the rear panel.

1.4 PERFORMANCE SPECIFICATIONS

The specifications for the Model 1045 are given in Table 1-3.

TABLE 1-3

PERFORMANCE SPECIFICATIONS

FREQUENCY RANGE	100 kHz to 18 GHz. (See Detector Table 1-1).	
POWER RANGES	Low Power Detectors	High Power Detectors
dB or dBm, Single Range	-50 dBm to +10 dBm	-20 dBm to +40 dBm
Watts, Decade Ranges	.1 µW to 10 mW	.1 mW to 10 W
Range Selection	Manual or Automatic	
DATA DISPLAY		
Digital	4 Digit, LED	

(Continued)

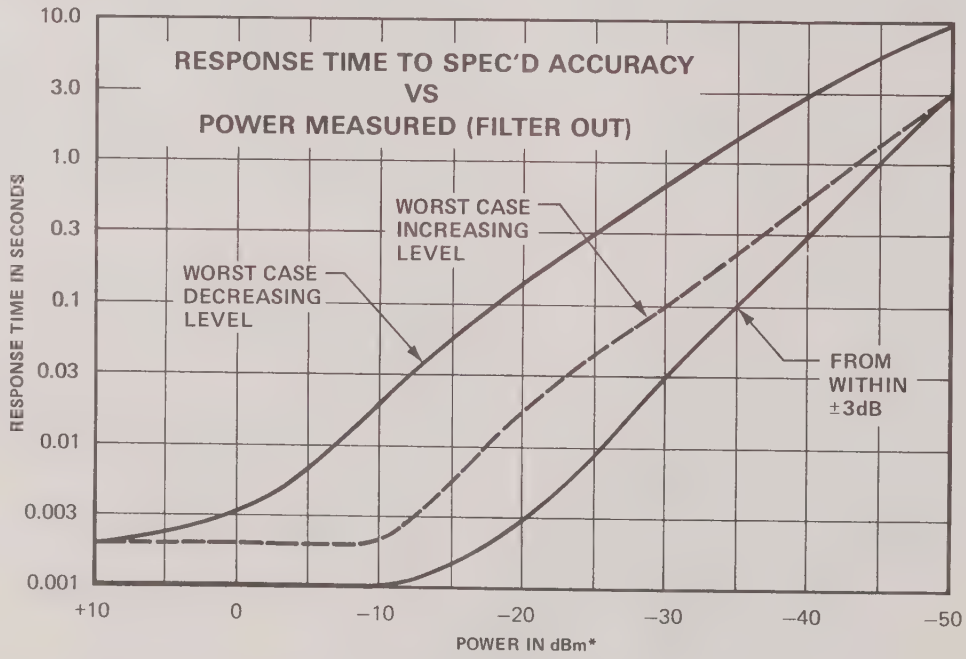
TABLE 1-3 SPECIFICATIONS (Contd)

Annunciators	dB, dBm, W, mW, µW, Over-range
Indicators	Cal, Zero, Remote, New Data, Detector Power Range
Analog Meter	For tuning, watt ranges and coarse zero only

SPEED

Reading Rate - Internal Trigger	4 readings/sec
Reading Rate - External Trigger	Up to 500 readings/sec
Auto Ranging Time, maximum	10 milliseconds

RESPONSE TIME



The analog response time of the instrument is determined by three factors:

1. The power level measured (higher power-faster response)
2. The power change from the previous reading (smaller change-faster response)
3. The direction of change from the previous reading (increasing response faster than decreasing response)

To optimize testing speed in automatic systems programs should be written which minimize the power change from one reading to the next and where large changes are in the increasing direction.

A delay should be programmed after the measured signal has been connected to the detector (or has settled to its desired value) and before the instrument is triggered.

(Continued)

TABLE 1-3 SPECIFICATIONS (Contd)

INSTRUMENTATION ACCURACY (INCLUDES DETECTOR LINEARITY)		
	15-35°C	0-50°C
+10 dBm to -35 dBm*	±0.1 dB	±0.2 dB
-35 dBm to -50 dBm*	±0.3 dB	±0.4 dB
10 mW to 1.0 µW*	2% of rdg.	4% of rdg.
1.0 µW to .01 µW*	6% of rdg.	9% of rdg.
CALIBRATION FACTOR		
Uncertainty	±0.1 dB to 12 GHz	
	±0.2 dB to 18 GHz	
Resolution	.02 dB	
Range	±1 dB	
ZERO SET		
Automatic (Fine)	Front panel button	
Coarse	Front panel screwdriver control	
REFERENCE SET		
Automatic	Front panel button	
Manual	Front panel knob	
ANALOG OUTPUT, < 1 ohm output impedance 3 mA max.		
dBm Ranges	100 mV/dB, ±1% (0 V for 0 dB) 60 dB dynamic range	
Watt Ranges	1.0 V per 1000 counts, ±1%	
CALIBRATOR	30 MHz, 10 mW, ±1.5%, 50 Ω, harmonics < -50 dB, return loss > 30 dB	
PHYSICAL PROPERTIES		
Operating Temperature Range	0-50°C	
Power Requirements	100, 120, 220, 240 VAC ± 10% 50-440 Hz, 24 VA	
DIMENSIONS	8.9 cm H x 43.3 cm W x 48.3 cm D (3-1/2" H x 17" W x 19" D)	
WEIGHT	9.5 kg (21 lbs.)	
SHIPPING WEIGHT	11.3 kg (25 lbs.)	
REAR CONNECTORS		
External Trigger Input	TTL Pulse > 0.2 µsec wide will trigger new reading. BNC.	
Analog Output	See above. BNC.	
Ratio/Marker Input	Allows 2 Model 1045's to be used together to display ratio of 2 signals. Allows insertion of marker. BNC.	
RF Blanking Output	TTL *Low* level during coarse or fine zero process available to turn off RF source. BNC.	
GPIB Connector	If Option 05 is ordered, the connector is compatible with IEEE STD 488.	
Detector Inputs (4)	If Option 01 is ordered, 4 position selector switch replaces front panel detector input.	

*For Low Power Detector; add 30 dB (X1000 for watt ranges) if High Power Detector is used.

1.5 ACCESSORIES

A list of accessories is given in Table 1-4. These include a rack adapter and additional cables.

TABLE 1-4

LIST OF ACCESSORIES

Model 1047	Rack Adapter (with slides)
P/N 14052	IEEE 488 Cable, 2 meters long
P/N 13937-1	Detector Cable, 1.5 meters (5 feet)
P/N 13937-2	Detector Cable, 3 meters (10 feet)
P/N 13937-3	Detector Cable, 7.5 meters (25 feet)
P/N 13937-4	Detector Cable, 15 meters (50 feet)
P/N 13937-5	Detector Cable, 30 meters (100 feet)

SECTION 2

INITIAL INSTRUCTIONS

2.1 RECEIVING INSPECTION

Inspect the instrument for shipping damage. See the receiving instruction under "Warranty" on page i at the beginning of the manual.

2.2 POWER REQUIREMENT

NOTE

Before applying power to the instrument from the line, be sure that the instrument is set for the correct line voltage.

The unit is normally set at the factory for operation at the normal supply voltage for the country in which it is sold. The input must be 50-400 Hz. The combination of the module and transformer design allows instrument operation on 100, 120, 220, or 240 volts. Conversion from one voltage to another may be made by changing the voltage selection p.c. board. See Figure 2-1.

2.3 CHASSIS GROUNDING

The instrument is supplied with a three-conductor NEMA type power cord. The instrument will be properly grounded if the plug is connected into a properly installed three-prong receptacle. If a three-prong to two-prong adapter is used, be sure that the pigtail lead of the adapter is grounded.

WARNING

Failure to properly ground the instrument can allow dangerous voltages to build up on the chassis which could become dangerous to operating personnel.

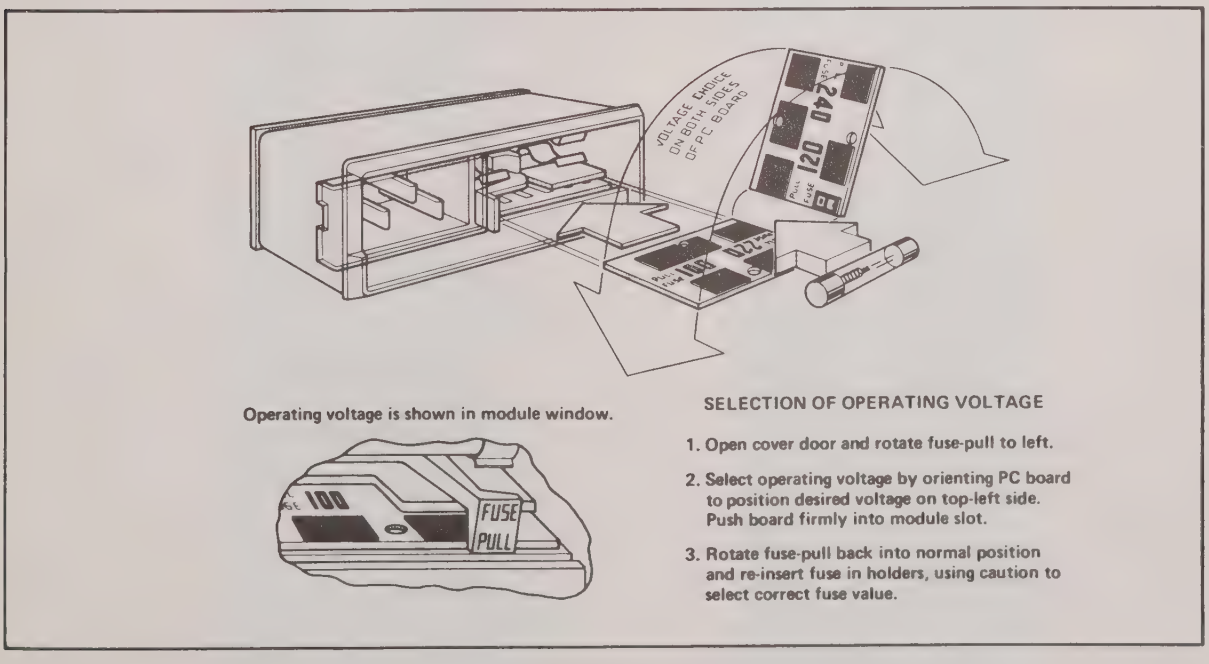
2.4 RETURNING THE INSTRUMENT

If it should be necessary to return the instrument to Pacific Measurements, see the shipping instructions under "Warranty", page i at the beginning of the manual.

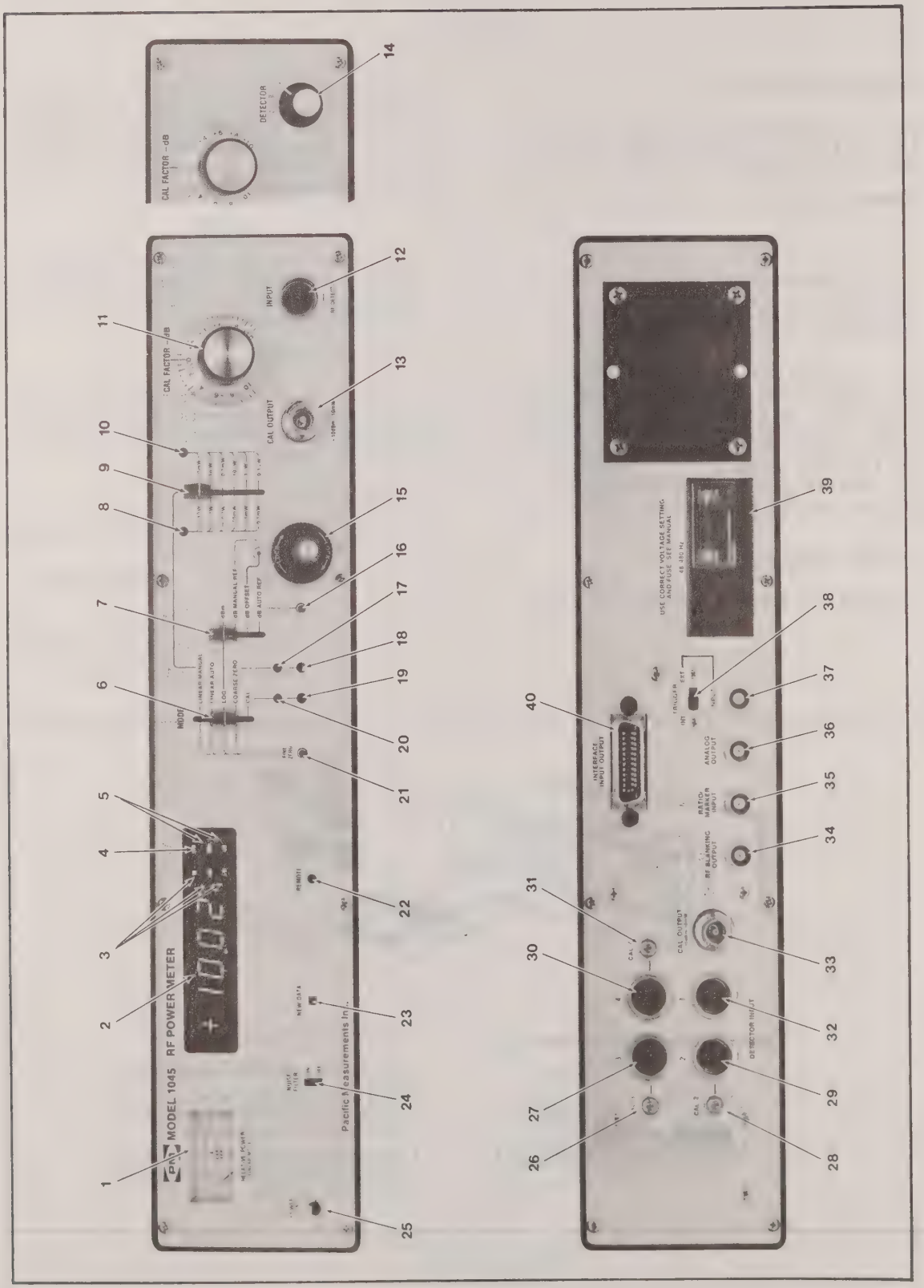
2.5 ACCESSORIES

The following are supplied with the instruments:

Qty	Part Number	Description
1	12356	Power Cord
1	14176	Instruction Manual
1	13937-1	Detector Cable, 1.5 m


VOLTAGE CHOICE ON BOTH SIDES OF PC BOARD
240
120
100
FUSE PULL
Operating voltage is shown in module window.
100
FUSE PULL
SELECTION OF OPERATING VOLTAGE
1. Open cover door and rotate fuse-pull to left.
2. Select operating voltage by orienting PC board to position desired voltage on top-left side. Push board firmly into module slot.
3. Rotate fuse-pull back into normal position and re-insert fuse in holders, using caution to select correct fuse value.

VOLTAGE SELECTION
FIGURE 2-1


MODEL 1045 RF POWER METER
Pacific Measurements Inc.
CAL FACTOR - dB
DETECTOR
INPUT
CAL OUTPUT
INTERFACE PANEL OUTPUT
RF BLANKING OUTPUT
RATIO MARKER OUTPUT
ANALOG OUTPUT
DETECTOR INPUT
TRIGGER
USE CORRECT VOLTAGE SETTING AND FUSE FOR YOUR LINE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

FRONT AND REAR PANELS
FIGURE 3-1

SECTION 3

OPERATION

3.1 CONTROLS, CONNECTIONS AND INDICATORS

The features on the front and rear panels are described here. The item numbers that are listed below refer to the callouts in Figure 3-1. There are six equipment options noted here; refer to 1.3 for a description of these options.

3.2 LIST OF FRONT PANEL FEATURES

1. ANALOG METER. Provides a display of the relative power for making power peaking adjustments of RF source in LINEAR mode. Also used for COARSE ZERO ADJUSTMENT.

2. DIGITAL DISPLAY. 4 digit LED display with sign and decimal point.

3. WATT RANGE LIGHTS. Enunciator for W, mW and µW, only selected in the LINEAR mode.

4. OVERRANGE LIGHT. Indicates that RF input power level is too large to be measured on the selected range.

5. dB/dBm LIGHT. Enunciator for dBm or dB, only selected in the LOG mode.

6. MODE. The switch to select the mode of RF input power measurement or calibration.

7. LOG. The switch to select the dBm, dB MANUAL REF, dB AUTO REF MODE or dB OFFSET in Log measurement of RF input power.

8. HI-PWR DET. LIGHT. Indicates the High Power detector is connected at the input and the instrument will measure from -20 to +40 dBm. Also indicates that the left column of LINEAR MANUAL ranges is selected.

9. LINEAR MANUAL. The switch to select the 10 mW (W), 1 MW (W), 0.1 mW (W), 10 µW (mW), 1 µW (mW) or 0.1 µW (mW) scale in Linear measurement of RF input power. The high or low ranges are automatically selected by sensing whether a high or low power detector is being used.

10. LO-PWR DET. LIGHT. Indicates the Low Power detector is connected at the input and the instrument will measure from -50 to +10 dBm. Also indicates that the right column of LINEAR MANUAL ranges is selected.

11. CAL FACTOR. Precision potentiometer which compensates for mismatch losses and efficiency of the Power Detector. A chart of CAL FACTOR (dB) versus frequency is imprinted on each Power Detector Assembly.

12. INPUT DETECTOR. Provides input connection for power Detector through the low noise Cable.

13. CAL OUTPUT. Provides RF output of 10 dBm (mW) for system calibration.

14. DETECTOR 1,2,3,4. Selects the detector connected to the DETECTOR INPUT connector 1 through 4 on the rear panel, Option 01 only.

15. dB MANUAL REF and dB OFFSET. These are two concentric adjustments and a lock ring. The outer control is a multi-turn pot used to manually set an RF input as a reference for a dB relative measurement. When used with an oscilloscope connected to the ANALOG OUTPUT connector on the rear panel, a point on the scope trace can be offset to zero using the inner control and a direct reading of the level at that point on the curve is displayed on the Model 1045 digital display.

16. dB AUTO STORE. Spring loaded pushbutton switch used to set an RF input automatically as the reference for dB relative measurement.

17. COARSE ZERO LIGHT. Indicates COARSE ZERO mode.

18. COARSE ZERO. Screwdriver adjustment for correcting the input offset errors of the Power Meter and the Power Detector in coarse zeroing operation.

19. CAL. Screwdriver adjustment for calibrating the Power Meter and the Power Detector to a known standard, generally the CAL OUTPUT.

20. CAL LIGHT. Indicates the CALIBRATION mode.

21. FINE ZERO. Spring loaded pushbutton switch for auto correcting the drift error of Power Meter and the Power Detector in fine zeroing operation.

22. REMOTE LIGHT. Indicates the front panel controls are disabled and the instrument is under the control of the IEEE Interface Bus.

23. NEW DATA LIGHT. This lamp flashes each time a new data is applied to the digital display. At high trigger rates, the light will appear to glow continuously.

24. NOISE FILTER. The slide switch which when turned on will provide more filtering of the noise in the amplifiers, so as to pro-

vide more stable digital readings. Particularly useful for low level measurements.

25. POWER ON/OFF. A toggle switch to apply AC line power to Power Meter when turned on.

3.3 LIST OF REAR PANEL FEATURES

26. FINE CAL #3. Screwdriver adjustment during the Calibrate mode to set Power Detector #3 with respect to Power Detector #1.

27. INPUT DETECTOR #3. Input connection for Power Detector #3 in the Multi-detector Option.

28. FINE CAL #2. Screwdriver adjustment during the Calibrate mode to set Power Detector #2 with respect to Power Detector #1.

29. INPUT DETECTOR #2. Input connection for Power Detector #2 in the Multi-detector Option.

30. INPUT DETECTOR #4. Input connection for Power Detector #4 in the Multi-detector Option.

31. FINE CAL #4. Screwdriver adjustment during the Calibrate mode to set Power Detector #4 with respect to Power Detector #1.

32. INPUT DETECTOR #1. Input connection for Power Detector #1 in the Multi-detector Option.

33. CAL OUTPUT. Takes the place of the front panel CAL OUTPUT connector in the Multi-detector Option.

34. RF BLANKING OUTPUT. The TTL open collector output is driven low during Coarse and Fine Zeroing operations, so it can be used to turn off the RF input signal.

35. RATIO/MARKER INPUT. The Connector may be used to inject a signal into the Power Meter for taking the ratio of two RF signals (in dB), or for providing video frequency Markers. The input sensitivity is -10 dB/V. This input is active only in the LOG mode.

36. ANALOG OUTPUT. Provides an analog output which can be used for Swept Frequency measurements. The output is 100 mV/dB in LOG mode, and is 1 V/1000 counts of Digital Display in LINEAR mode.

37. TRIGGER INPUT. The Connector for triggering the Digital Display by an external source when the TRIGGER switch is in EXT position. The Display may be triggered at any rate from 0 to 500 reading per second. A minimum pulse width of 0.2 μ sec is required.

38. INT/EXT TRIGGER. The slide switch selects either the internal triggering at 4 times a second, or the external triggering from TRIGGER INPUT. The trigger is used to start a new data conversion for the Digital Display.

39. LINE POWER CONNECTOR AND SELECTOR. Connection for the input power. The number visible on the card (100, 120, 220, or 240 Vac) indicates which of the nominal line voltage to which the instrument must be connected. See 2.2 and Figure 2.1 for instructions to change for the input voltage.

40. INTERFACE CONNECTOR. Connection for the IEEE Interface Bus Cable to a remote Controller, or the cable for the BCD output.

3.4 OPERATING PROCEDURE

The item numbers that are in parenthesis refer to the callouts in Figure 3-1.

CAUTION

Measuring continuous or peak levels of +23 dB (200 mW) or greater can damage the detector semi-conductor diode. Always ensure that the RF power is below this level before connecting the Model 1045 to the RF power source.

a. Set up. Connect the power cord. Ensure that the correct voltage is selected at the power input jack (39). Switch the power switch (25) up (on).

b. Calibrate the Model 1045. Connect the CAL OUTPUT connector to the INPUT DETECTOR with a suitable cable. For option 01, select the INPUT DETECTOR connector on the front panel. Set the MODE switch (6) to CAL and with a screwdriver, adjust (19) for a reading of + 10.00 dBm on the display. Disconnect the cable from the CAL OUTPUT connector.

c. Set the COARSE ZERO ADJUSTMENT. Disconnect any RF input to the instrument unless there is an RF BLANKING connection to the detector. In this case, when the RF BLANKING OUTPUT (34) is connected to the detector, the RF input will be disabled automatically. Adjust (18) with a screwdriver, so that the needle of the analog meter is centered.

d. CAL FACTOR -dB ADJUSTMENT. Set the CAL FACTOR -dB ADJUSTMENT (11) according to the printed chart of the calibration factor (dB) versus the frequency shown on each detector. This control is only con-

nected during the linear and dBm measurement.

e. Set the FINE ZERO ADJUSTMENT. Disconnect the RF power source and press the FINE ZERO button (21). If the instrument is in the COARSE ZERO mode, the LED will go out while the machine calibrates itself, and comes back on when the function is completed, about 3-4 seconds. This may be necessary about each 5 minutes of operation at low power levels (-30 to -50 dBm).

f. Making an RF Power Measurement. Connect the RF power source to the instrument and select it if more than one source is connected. Select the mode desired on the MODE switch (6). If the LINEAR MANUAL is selected, the range must be selected by (9). The high or low range is selected automatically, and the LED (8) or (10) indicates which is selected. The OVERRANGE LED (4) lights to indicate a range change. In the LINEAR AUTO mode, the instrument selects the range automatically.

In the LOG mode, the instrument measures in dBm or dB. Switch (7) must then be set to select the mode, dBm, dB MANUAL REF, dB AUTO REF, or dB OFFSET.

g. Fluctuating Readings at Low Power Levels. Switch the NOISE FILTER switch (24) on to stabilize the display.

h. Using an RF Input for a Relative Measurement. If it is required to use one RF level as a reference, the difference between that level and another level can be displayed directly. Set the instrument in the LOG dB AUTO REF mode with switches (6) and (7). Press the dB AUTO STORE button (16) when the reference level is being displayed. Any subsequent measurement will be measured relative to this level. To cancel, switch out of the dB AUTO REF mode.

i. Making a Measurement Using the Offset Feature. Set the MODE switches to LOG (6) and dB MANUAL REFERENCE (7). Connect a sweep generator to a DETECTOR INPUT, which has the desired reference CW Power applied to it. Connect an oscilloscope to the ANALOG OUTPUT (36) and with the dB MANUAL REFERENCE control set the scope display to a zero reference. Lock the control. Set the MODE control (7) to dB OFFSET, and the source to sweep. Rotate the control until the desired part of the sweep is at zero level. The offset required for this is displayed on the meter.

j. Putting a Marker on an Oscilloscope Trace. Connect the sweep generator and oscilloscope as described in (i) above. Connect the marker output of the generator to the RATIO/MARKER INPUT (35). Set the frequency of the marker at the generator. The marker will sit on the trace at the frequency selected.

3.5 SET UP FOR OPERATION VIA THE IEEE BUS (OPTION 05)

a. Set the Listen Switch Array (S1, 1 thru 5) on the Interface Board as shown in Table 3-1. The switch location is shown in Figure 3-2

TABLE 3-1

ADDRESS SWITCH SETTING EXAMPLES

Switch #	Binary #	1	2	3	4	5
Address 1	00001	open				
Address 10	01010		open		open	

1. Set switch #6 open if an external trigger is to be supplied. Connect the trigger source to the EXT TRIG connector (38) on the rear panel. If the unit is to be triggered remotely from the calculator, set S6 closed.

2. Set switch #7 open if the CAL FACTOR control is required. If this function is to be performed by the calculator as part of the processing when the results have been retrieved from the Model 1045, close S6.

b. Set the TALK SWITCH ARRAY (S2, 1 thru 5) on the Interface Board for the talk address required. See Table 3-1.

1. Set switch #6 open if the instrument is to generate a service request when data is received.

2. Set switch #7 open if the instrument is to listen and talk on the IEEE bus. Set to closed if it is to talk only.

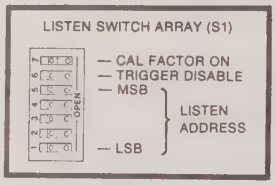


Figure 1

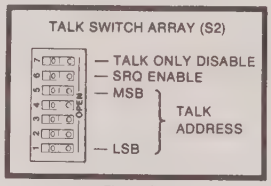


Figure 2

Figure 3

CAL FACTOR OFF
TRIGGER DISABLED
0
1
0
1
1

To set a true value for a bit, the corresponding switch must be opened. To do this, press down on the small dimple closest to the legend "open." A small screwdriver or ball-point pen is useful for this. To set a false condition, press the side opposite the legend "open."

Example: Assume it is desired to set the following conditions on switch S1:

Cal Factor off
Trigger Disabled
Listen Address = 11 (binary 01011)

To do this, set bit 1, 2, 4, and 6 open, and bit 3, 5, and 7 closed. Figure 3 is an oblique view of S1 set in the above conditions.

OPTION 05 IEEE 488 INTERFACE SELECTOR SWITCHES OPERATION

FIGURE 3-2

SECTION 4

PERFORMANCE CHECKS

4.1 GENERAL

The purpose of this section is to provide a means of verifying proper operation on incoming inspection and when making periodic performance evaluations. If the instrument passes the tests listed below it may be assumed to be operating properly and used with confidence. These tests do not check the operation of the power detector, as they are only intended to check the operation of the indicating instrument. The power detector may be checked using a properly calibrated Model 1045 as an indicating unit. The procedure for checking power detectors is included in the instructions for the detector.

4.2 EQUIPMENT REQUIRED FOR PERFORMANCE EVALUATION

The following equipment is required to perform the measurements of this section.

a. A step attenuator with 10 dB steps to 60 dB. The accuracy must be known to ±0.02 dB at 30 MHz.

b. A 30 MHz, 10 mW ± 0.5% power source, low distortion (harmonic and non-harmonic spurious signals better than 50 dB down) and well matched (VSWR less than 1.06).

c. A 30 MHz power measuring device with an accuracy better than 0.5% such as a Fluke A-55 thermal converter, or an accurately known (0.5%) 30 MHz, 10 mW, low distortion, well-matched source (< 1.065).

d. A DVM with 0.03% accuracy and up to 0.1 mV resolution.

e. A precision power supply with 0.03% accuracy and 6 volts output at low current (< 10 ma).

f. A low power detector (see Table 1-1).

NOTE

1. Allow a 30 minute warm-up period before performing these tests.

2. If the instrument does not meet the tolerances given here, go to Section 6 for re-calibration.

4.3 PERFORMANCE TESTS

The item numbers that are in parenthesis refer to the callouts in Figure 3-1.

a. Power tracking check.

1. Connect the step attenuator to the 30 MHz, 10 mW source and connect the 1045 detector to the attenuator.

2. Set the attenuator to OFF if it has such a position or turn off the RF power if not.

3. Select the COARSE ZERO mode (6). Adjust the COARSE ZERO (18) until the ANALOG meter (1) reads approximately center scale.

4. Press FINE ZERO (21) and wait until the COARSE ZERO light (17) is on again.

5. Select the LOG and dBm mode and turn on attenuator. Apply +10 dBm to the detector. Adjust the front panel CAL control (19) for a reading of +10.00 dBm on the display.

6. Decrease the power in 10 dB steps to -30 dBm and at each step check that the 1045 reads the correct power ±0.1 dB. Be sure to correct for the error in the step attenuator.

7. Reduce the power to -40 dBm and then -50 dBm and at each step check that the correct power ±0.3 dB is displayed.

b. Function checks.

1. Apply 0 dBm (10 dB atten.) and select the LINEAR AUTO range (6). The display should indicate 1.000 mW ± 2%.

2. Select the LINEAR MANUAL mode (6). Set the scale to 10 mW and check the display is 01.00 mW ±0.03 mW.

3. Select LOG, dB MANUAL REF mode (7). Verify that the control allows adjustment from more than -10 to more than +50 dB.

4. Select LOG, dB AUTO REF mode (7). Press dB AUTO REF button (16) and check that the display indicates 0 dB ±.05 dB.

5. Select LOG, the dB OFFSET mode (7). Connect the DVM to the analog output and adjust the dB OFFSET control (15) for 00.00 dB on the display. If the analog output voltage is not zero, set it to zero with the dB MANUAL REF control (15).

NOTE

Do not rotate the inner dB OFFSET control or the display will

be affected.

Lock the dB MANUAL REF control. Set the dB OFFSET control (15) for a reading of 50.00 dB on the display. Check that the analog output voltage is 5.00 volts ±0.01 volts. Disconnect the DVM.

6. Select the LOG, dB MANUAL REF mode (7). Connect the precision power supply to the RATIO/MARKER INPUT (35). Adjust the dB MANUAL REF control for a reading of 00.00 with the precision supply set to zero volts. Set the precision supply to 6.00 volts and check that the display reads 60.00 dB ±0.13 dB. Disconnect the power supply.

c. Calibrator.

1. Connect the precision power measuring device (see 4.2b) to the calibrator output. Select CAL mode (6). The power output should be 10.00 mW ±0.16 mW ± the accuracy of the measuring device. If a thermal converter with an accuracy of 0.1% is used, the additional error due to its use can be ignored.

2. Alternatively:

a. Connect the 1045 detector to the 30 MHz source, select the dBm mode and adjust the front panel CAL control (19) for exactly +10.00 dBm ±0.01 dBm. (Be sure the CAL FACTOR control (11) is set to exactly 0 dB.)

b. Remove the detector from the external power source and connect it to the CAL OUTPUT (13).

c. Select the CAL mode and check that the reading on the display is 10.00 dBm ±0.07 dB ± the accuracy of the precision source.

SECTION 5

CIRCUIT DESCRIPTION

5.1 INTRODUCTION

A block diagram of the 1045 is given in Section 8. This figure shows the basic instrument with local control and a single input. The interface (GPIB) option is shown on the block diagram, but this will only apply to the -05 version. A description of each circuit is given in this section and the schematics are shown in Section 8. The item numbers that are in parenthesis refer to the callouts in Figure 3-1.

5.2 THE MODEL 1045 BLOCK DIAGRAM

The unit is divided into two parts, isolated input and circuits grounded to the chassis. All circuits before the Isolation Amplifier have a floating ground to prevent unwanted currents in the signal ground leads from affecting the sensitivity of the measuring circuits. A floating power supply provides an isolated dc power source. A differential amplifier transmits the signal from the isolated input circuits to the output circuits. The isolated circuits are described first.

The RF detector inside the Detector Assembly converts the RF power incident upon it to a dc voltage, which is proportional to the input power at low levels, and gradually becomes proportional to RF voltage at the higher levels. The sensitivity at low levels and the point where the change from power to voltage detection begins depend on the detector temperature. The detector temperature is monitored by a thermistor in the detector and the output used as a correction factor. The thermistor is mounted in contact with the detector shell. Since sensitivity will vary with each detector, a selected resistor is also mounted in the detector to compensate for these individual characteristics. A logic signal level is also generated by the detector to allow the power meter to distinguish between a low power or a high power detector (with a 30 dB pad).

The Detector Temperature Compensation Amplifier takes the high impedance signal from the thermistor, and outputs a low impedance signal proportional to the temperature for the Square-Law Compensation Circuit and Isolation Amplifier.

The Pre-amplifier (Chopper Amplifier) is a non-inverting chopper stabilized low-noise amplifier. This circuit reduces the thermal drift to an absolute minimum and provides a very high input impedance. A 1 kHz RC oscillator provides the drive voltages for both the chopper pre-amplifier and the stabilizing chopper amplifier for the Log Amplifier circuit. The Pre-amplifier has a gain of 13 and it feeds directly to the Log Amplifier and indirectly through the Square-Law Compensation circuit.

This Compensation Circuit becomes active for an RF input above approximately -27 dBm. It generates a current nearly proportional to the square of the input voltage. This current is summed in with the current from the Pre-amplifier at the input to the Log Amplifier. At high signal levels, the detector output voltage departs from the Square-Law, but the current from the Compensation Circuit increases in such a way so that the total current still corresponds to a Square-Law signal. In this way, variations due to temperature and detector characteristics are compensated for.

The Chopper Logarithmic Amplifier has a very wide dynamic range, from less than 0.09 µV to greater than an equivalent input of 90 V. In order to be free of drift over this 60 dB dynamic range, it is chopper stabilized. A PNP transistor in the temperature-stable oven is used as the logging element. A filtering network is connected in the feedback path of the Log Amplifier to reduce the noise and can be switched in (Filter Control) to stabilize the display at low power levels. An amplifier following the logging circuit provides a gain of 15 to raise the signal level to 100 mV/dB.

The FINE ZERO circuit samples the output of the X15 Amplifier, and provides an offsetting signal for the Pre-amplifier to correct for any drift in the amplifier chain.

A Differential Amplifier provides a means of transferring the signal from the isolated circuit to a ground referenced signal. It has a high input impedance for good isolation and good common-mode voltage rejection so that parasitic signals appearing on the bench ground to which the detector is attached will be ignored. Potential ground-loop currents are kept negligible by a current mirror arrangement. The output of the Isolation Amplifier is then fed into the Summing Amplifier.

The Control Multiplexer is a multiplex circuit on the control board that takes a control input from either the front panel or the interface board option (when installed) and generates the necessary control levels for the operation of the instrument, and lights the indicator lamps. This board also selects one of the four RF detector inputs either from the front panel or the IEEE Bus Interface control where both the multi-detector and IEEE Bus options are installed. The input selected determines the level of the bias current that will be supplied to the Summing Amplifier. The RATIO/MARKER INPUT allows summing a reference input independently of the Summing Amplifier.

The Auto Reference Sample and Hold circuit samples the output of the Summing Amplifier and

holds it for the dB AUTO REF measurement. The Meter Amplifier drives the analog meter for peaking and coarse zeroing.

The output of the Summing Amplifier is fed to the Display Multiplexer where it is available at the ANALOG OUTPUT connector. The Summing Amplifier output also goes to the Anti-Log Amplifier where it is converted into linear form. This signal is transmitted via the Display Multiplexer to the Analog-to-Digital Converter, where it is converted to BCD format. This drives the instrument's DIGITAL DISPLAY, and is also available for the IEEE Bus.

The IEEE Bus input and output requires an interface board which decodes the inputs from the bus and sends the measured RF data in ASCII form to the remote calculator. All control and handshake signals are provided for.

An accurate 30 MHz 10 milliwatt output is provided for from the CAL OUTPUT connector on the front panel used to verify the calibration of the instrument. A Local/Remote control from the IEEE Bus disables the front controls whenever the instrument is addressed by the remote controller.

5.3 THE CONTROL BOARD

Refer to the circuit diagram 13456 (4 sheets) in Section 8. The Control Board contains a multiplex circuit that accepts inputs from the front panel controls or the IEEE Bus via the IEEE Interface Board, (when this option is installed) and other automatic inputs (Trig Auto, Autoranging). Depending on the input selected, the correct level of bias is supplied to the Summing Amplifier, and the correct indicators, enunciators and decimal point position is lit. It also contains the Sample and Hold circuit for the AUTO dB functions.

5.3.1 MODE SWITCH SELECTION (Sheet 1)

Inputs from the MODE switch and LOG switch positions are shown at the top of the drawing. Inputs from the IEEE Bus are identified with the suffix 'B'. Inputs from these sources are NOR'ed, the bus input taking precedence over local control. The output from the NOR gate lights the related indicators on the front panel, and supplies a HI or LO logic level output as shown on the schematic. Note that A5S2 is only active when A5S1 is set in position 3. A5S5 causes the instrument to store a reference level and also (from Sheet 4 via the RF OFF inputs to A1U3C) enables the RF Blanking, and via A1U9B disables the FILTER switch on the front panel. A1S6 selects the noise filter to give greater stability at very low power levels. $\overline{\text{FIL B}}$ allows this function from the bus.

5.3.2 RANGE SELECTION (Sheet 2)

These circuits select the range of the instrument thus determining the position of the decimal point, (A12, 13, 16) and lighting the LED to indicate high (mW) or low (µW) range selected. This selection is made automatically from the PAD ID input from the detector which makes either $\overline{\text{mW}}$ or $\overline{\mu\text{W}}$ true. The ranges are selected in one of the following ways:

a. LINEAR MANUAL. The range is selected by the setting of A5S3.

b. IEEE Bus. The range is selected from the remote controller via the bus, and via inputs $\overline{10\ \text{mWB}}$ thru $\overline{0.1\ \mu\text{WB}}$.

c. LINEAR AUTO Mode. Selected on the front panel, an over or underrange is detected (see Sheet 4) and the range selected is controlled via $\overline{\text{C0}}$ thru $\overline{\text{C5}}$. The output from A1U8D (11) selects the Linear Mode when $\overline{\text{LIN MODE}}$ is true, or LOG Mode when it is false.

5.3.3 OUTPUT BIAS SELECT (Sheet 3).

The Output Bias provides an offset voltage level to the Summing Amplifier on the Analog Board to suit the input and range selected. Inputs from the range selection and the MAN ZERO, CAL FACTOR, MAN dB REF, MAN ZERO, and AUTO REF dB inputs from Sheet 1 switch the transistor of a transistor-FET pair. The FET, through a precision resistor, provides the required bias level.

5.3.4 FET SWITCH LOGIC

The following is a list of logic expressions that drive the FET switches. "+" is the OR operator, "•" is the AND operator. The subscript B indicates bus control.

MAN ZERO OFFSET (A1Q6) = COARSE ZERO MODE

CAL FACTOR (A1Q7) = LINEAR MODE + dBM + "CAL FACTOR ON" • REMOTE

MAN REF dB (A1Q8) = dB MANUAL REF MODE + dB OFFSET MODE

CAL (A1Q9) = $\overline{\text{COARSE ZERO MODE}}$

AUTO, dB REF (A1Q10) = dB AUTO MODE

(A1Q18) = 0.1 µW

(A1Q19) = 1 µW + 10 µW + HI-PWR

(A1Q20) = 0.1 mW + 1 µW + HI-PWR

(A1Q21) = $\overline{10\ \text{mW}}$

THERMISTOR (A2Q23) = $\overline{\text{COARSE ZERO MODE}}$

AUTO ZERO (A2Q29) = $(\text{AUTO ZERO})_B$ + $\overline{\text{COARSE ZERO}}$ + COARSE ZERO • ZERO SAMPLED

ZERO OFFSET (A2Q30) = COARSE ZERO MODE + ZERO SAMPLED

ANALOG METER (A2Q38 & Q39) = COARSE ZERO MODE + LINEAR MODE

$\overline{\text{FILTER ON}}$ (A2Q45) = $(\text{FIL})_B$ + FILTER • $\overline{\text{ZERO SAMPLED}}$

LIN MODE (A2Q43) = LINEAR MANUAL MODE + LINEAR AUTO MODE

dB MODE (A2Q50) = LOG MODE + COARSE ZERO MODE + CAL MODE

Other levels are determined from the controls on this sheet of the schematic. The CAL FACTOR -dB, dB AUTO REF, dB OFFSET and CAL levels are also supplied via an FET when the respective transistor is turned on.

5.3.5 AUTO dB SAMPLE AND HOLD (Sheet 3)

A1U1 on Sheet 4 controls this function. When the AUTO dB STORE (A5S7 on Sheet 1) is pressed, the Trig 1 input to A1U1 sends $\overline{\text{REF SAMPLED}}$ true. AUTO dB COMP is true for about 60 milliseconds turning on A1Q23 and A1Q26 for this period so that the AUTO dB COMP on the Analog Board can charge A1C5 to a reference voltage. At the end of this period, A1U23 supplies this reference voltage to the Summing Amplifier. Both A1U23 and A1Q23 are low-leakage devices to minimize the drift of this reference voltage. During this holding period, A1Q24 is turned on to ensure that A1Q26 will not be accidentally driven into conduction by the comparator.

5.3.6 LEVEL DECODER (Sheet 4)

Detector inputs through A1, A3 and A4 are from the display A1U13, A1U14 and detect an over or underrange, which sends A1U13D (12) LO. If $\overline{\text{RANGE HOLD}}$ B is true, a range hold cannot take place. When AUTO RANGE is true and $\overline{\text{AUTO LIN}}$ B is false, a range change is requested and the range is triggered to zero. A1U4 then counts from zero upwards in binary, synchronized by the Auto Clock from the A-D Converter. This drives decoder A1U5 which sweeps through outputs $\overline{\text{C0}}$ thru $\overline{\text{C5}}$. This will eventually select a range in which there is neither an over or underrange and the instrument will remain in that range. $\overline{\text{C0}}$ thru $\overline{\text{C5}}$ selects the range through the multiplexer on Sheet 1.

5.3.7 NEW DATA (Sheet 4)

The Trig 1 input drives one-shot A1U1, which pulses the NEW DATA LED. The duration of each pulse is 10 milliseconds controlled by RC network A1R90-A1C12, and there are about four pulses per second when the INTERNAL TRIGGER is operating the LED.

5.3.8 FINE ZERO (Sheet 4)

The Fine Zero timing is generated by one-shot A1U24. The FINE ZERO button is pressed, the RF BLANKING OUTPUT is driven LO, A1Q25 is switched off and A1C8 charges to the level of the B input at A1U24 in approximately 4 seconds. This error voltage is stored and used to correct the drift error at the front end amplifiers on the Analog Board.

5.3.9 OVERRANGE LED (Sheet 4)

The Overrange (OR) lamp turns on when the display exceeds 6999 or when the amplifiers saturate at approximately +10.5 dBm. The lamp is blanked for about 400 microseconds when an A-to-D conversion is initiated.

5.3.10 COARSE ZERO AND CALIBRATE (Sheet 1)

These functions are selected on the front panel, or MAN ZERO B and CAL B signals from the bus respectively. $\overline{\text{SELF TRIG}}$ is driven LO during this mode to gate the internal oscillator to trigger the A-to-D converter. In either the CALIBRATE and COARSE ZERO modes a trigger is required even if the INTERNAL TRIGGER is disabled. This is supplied via NOR gate A1U20A which goes LO when either of these modes is selected.

5.4 ANALOG BOARD

Refer to the circuit diagram 13510 (4 sheets) in Section 8. The Analog Board contains the Input Pre-amplifier, Log Conversion Circuit, Square-Law Compensation Circuit, Zeroing Circuit, Oven Controller, Offset Circuit, Potpourri Circuits and Anti-Log Circuit.

5.4.1 INPUT PRE-AMPLIFIER

The Input Pre-amplifier is a non-inverting chopper stabilized amplifier. It consists of an input chopper to convert the input dc voltage to square wave, a high gain ac amplifier, a synchronous detector to convert the amplified square wave back to dc, and a dc amplifier to provide additional gain and a low output impedance. An oscillator circuit provides the switching waveforms required to drive the chopper and synchronous detector. Overall feedback determines the gain and makes the amplifier less dependent upon the parameters of the components than an open loop amplifier would be.

Integrated circuit A2U1 (Sheet 1) is a combination oscillator and frequency divider chain. The oscillator runs at 64 kHz and the Six-stage divider divides the frequency down to 1 kHz. Output from the 2 and 4 kHz dividers are combined in A2U2 to provide narrow pulses to drive the synchronous detector. Fig. 6-1 shows a timing diagram for this circuit. Square wave signals of opposite phase are supplied to A2Q1 and A2Q2, alternatively turning one on then the other. The result is that the input of the ac amplifier is first connected to the input signal

then to the feedback resistor. The ac amplifier consists of the transistors A2Q3 through A2Q11. It has sufficient bandwidth so that the signal at the emitter of A2Q11 is essentially a square wave with an amplitude proportional to the difference between the input and the signal fed back from the output of the amplifier A2U3. A2Q12 and A2Q13 are turned on briefly at alternate ends of the square wave period. Transient signals due to the switching of the input to the amplifier have decayed by the time output switches are turned on at the end of the period. The feedback resistive divider is selected to allow a gain of 12.8. For high frequency signals, A2C20 and A2C22 provide the chopper bypassing so the pre-amplifier can respond faster to the input signal.

5.4.2 LOG CONVERSION CIRCUIT (Sheet 2)

The Log Conversion Circuit is a high gain operational amplifier with feedback from the collector of a transistor. The emitter base voltage of the transistor A2Q24 is proportional to the log of the collector current over many decades of current values. To maintain the logarithmic coefficient independent of ambient temperature, the logging transistor A2Q24 is mounted in a temperature controlled oven and held at 60°C; at this temperature the emitter-base voltage changes by 66.5 mV for each factor of ten that the collector current changes. Since a factor of 10 represents 10 dB, this is 6.65 mV/dB. The amplifier A2U9B follows the log transistor with a gain of 15, raising the level to 100 mV/dB.

The operational amplifier part of the log conversion circuit is also chopper stabilized to minimize the effect of drift. Since the sensitivity is not as great as the pre-amplifier, the circuit is simplier. The op-amp A2U9A receives ac signal directly through A2C46; dc signals are routed through the chopper amplifier A2U7 and go to the non-inverting input of A2U9A. The current summing junction is common to the chopper input and A2C46. If at any time the summing junction is not at zero dc potential, the chopper switching transistor A2Q18 will convert this potential to an ac signal. The ac amplifier A2U7 amplifies the signal and supplies it to the synchronous demodulator A2Q19 and A2Q20 where it is converted back to dc. A low pass filter, A2R77 and A2C49, removes the ac component and the dc correction signal causes the output of A2U9A to change the current through the logging transistor in order to bring the summing junction back to zero. The 1 kHz drive for the chopper comes from the circuit driving the input chopper, Chopper Switching input.

In addition to the logging factor changing with temperature, the saturation current of the logging transistor also changes. To compensate for this effect, the other half of the matched transistor pair A2Q24 is supplied with a fixed current and a differential amplifier A2U9B amplifies the difference in the emitter base potential between the logging and compensating transistors.

To reduce the noise at low input levels, two switchable filter networks (Sheet 4) are shunted across the feedback path of Log amplifier A2U9A. The filter networks are high order circuits that shrink the bandwidth of the amplifier as input levels drop lower. Only one of the filter network will be engaged at any time; when the NOISE FILTER is switched on, A2Q49 is turned off and A2Q45 is turned on, and vice versa. The filter network connected to A2Q45 provides much more noise suppression than the filter network connected to A2Q49, so the digital display is more stable when NOISE FILTER is ON.

5.4.3 SQUARE-LAW COMPENSATION CIRCUIT

Above -27 dBm the detector begins to depart significantly from square-law and becomes linear. Since the instrument is required to be linear in power, compensation is required so that the total current supplied to the logging circuit summing junction A2U9B (8) continues to be square-law at all levels within the range of the instrument. This is accomplished by generating a signal proportional to the square of the input signal and adding it to the input at the log amplifier summing junction. This signal is negligible at low input level and is many times larger than input signal at high levels. The squaring function is implemented by first logging the input signal, amplifying the logged signal by a factor of 2 and taking the anti-log.

Integrated amplifier A2U5 has feedback supplied by the diode connected to pin 8 of A2U6. The voltage at pin 8 of A2U6 will be proportional to the log of the input voltage at levels above -27 dBm. The circuit will be inactive at low levels due to the offsetting action of A2R51. The diode connected to pin 11 of A2U4 acts merely to limit the voltage excursion of A2U4 when the circuit is inactive. The diode connected to pin 5 of A2U6 transmits the signal to A2U8 and compensates for the changes in saturation current with temperature of the logging diode. Amplifier A2U8 has a gain of 2 (slightly adjustable by A2R68) and supplies the amplified voltage to the diode connected to pin 2 of A2U6 which generates the anti-log function. The diode connected to pin 3 of A2U6 compensates the anti-logging diode for changes in saturation current with temperature. All of the diodes in A2U6 are essentially identical because they are part of an integrated circuit. The current from pin 1 of A2U6 is thus proportional to the square of the input voltage and it adds with the current fed directly from the input pre-amplifier at the input summing junction of the log amplifier.

5.4.4 TEMPERATURE COMPENSATION

Amplifier A2U10A supplies temperature compensa-

ting signals to the square-law compensation circuit by way of A2R97 to correct for shifts in detector sensitivity with temperature and to the output amplifier. The signal supplied to the compensation circuit corrects only for linearity so additional correction is required at A1U1 to correct for changes in overall sensitivity. This is accomplished by injecting current through A2R95 from A2U10A to the input of the isolation amplifier A2U16B. A2U10A is arranged as a bridge amplifier fed from a high impedance thermistor. The output of the amplifier is very nearly proportional to temperature from 0 to 50°C.

5.4.5 ZEROING CIRCUIT

The Zeroing Circuit corrects for the small offset and drift of front-end amplifiers. With the RF source turned off, a constant voltage through A2Q30 provides a small offset to the input pre-amplifier during coarse and fine zeroing. This offset corresponds to equivalent input level of approximately -55 dBm, so it can be used to calibrate the instrument for low level measurements.

During fine zeroing operation, the output of A2U9B is compared with a reference voltage set corresponding to this zero offset signal, the error voltage from the output of the comparator A2U10D is then sampled by A2Q31 and hold by A2C71. This voltage is buffered by a voltage follower A2U13 before being injected to the summing junction of the input pre-amplifier. So the whole front-end amplifier chain is essentially an error correcting feedback system.

5.4.6 OVEN CONTROLLER

The oven temperature is regulated and maintained at 60°C by the oven control circuit. A power transistor A2Q33 serves to heat the oven and a thermistor mounted in the oven senses temperature. When the oven is at its correct temperature, the two inputs to the amplifier A2U14 are equal. If the oven cools slightly, the value of the thermistor increases causing the output of A2U14 to become more positive and increase the current through A2Q32 and A2Q33. This causes A2Q33 to generate more heat, returning the oven to the correct temperature so that the thermistor circuit is once more in balance. At equiliberium, the circuit is just slightly off balance and the transistor supplies just enough heat to account for the heat loss to the surroundings.

5.4.7 OFFSET CIRCUIT

A differential amplifier A2U16B transfers the logarithmic signal from the floating ground circuits to the chassis ground circuits. Its inputs are connected to the output of the log conversion circuit and the isolated signal common. Since it has a good common mode rejection, only the signal between the log conversion circuit's output and isolated common will be amplified. This differential amplifier acts as an unity gain isolation amplifier; its output feeds the offset summing junction through A2R186. In order to minimize current flows between the isolated common and the chassis common, a current-mirror amplifier A2U16D provides a return path for the current injected by the isolation amplifier.

Several other signals from control board A1 are applied to the summing junction; each signal independently offsets the summing amplifier A2 U17B an amount corresponding to the current applied. These signals consist of (1) CAL, (2) CAL FACTOR, (3) MANUAL dB REF, (4) LINEAR OFFSETS, (5) COARSE ZERO and (6) AUTO dB REF. The output of summing amplifier feeds the Anti-log circuit, Auto dB comparator, Meter amplifier and the Ratio amplifier.

5.4.8 POTPOURRI CIRCUITS

The Meter amplifier drives the analog meter to show the relative power and coarse zeroing. FET A2Q39 switches on in LINEAR mode and A2Q38 switches on in COARSE ZERO mode. Diode A2CR13 protects the meter by limiting the meter movement.

Comparator A2U16A sets the overrange condition when input levels exceed 10.5 dBm.

The RATIO/MARKER INPUT is buffered by the voltage follower A2U17D before it is combined with the output of the summing amplifier at inverter A2U17C. This arrangement allows two Model 1045 units to be used together for ratioing (taking the difference in dB) two RF signals without the need for any adjustment. It can also provide a video frequency marker. A positive going signal in this input causes a negative going output signal.

Two sets of reference voltages are provided on the board. Each pair of these reference voltages derives its reference from a temperature stable Zener diode. A2U10A and A2U10B supply the -12 V and +12 V isolated reference voltage to the floating ground circuits. A2U15B and A2U15C supply the -10 V and +10 V reference voltage to the chassis ground circuits.

In the LOG mode, FET switch A2Q43 is turned on to measure the input RF signals in terms of dB; vice versa, switch A2Q50 is turned on in the LINEAR mode to measure the input RF signals in terms of Watts.

5.4.9 ANTI-LOG CIRCUIT

An Anti-Log Circuit is used to get the linear watt output from the log signal. Amplifier A2U15C drives the emitter of A2Q46 (pin 3) in proportion to the input voltage. The collector current of A2Q46 (pin 1) varies exponentially with the emitter-base voltage. This current is

converted to voltage by amplifier A2U15D. To maintain the coefficient of exponential independent of ambient temperature, the transistor is mounted in the same oven as the logging transistor. Since the saturation current of a transistor varies in a wide range, it is desirable to eliminate the effects of this variation by supplying the other half of the matched transistor pair A2Q46 with a fixed current, so the output voltage is directly proportional to this fixed current instead of the saturation current.

5.5 DISPLAY LOGIC AND CALIBRATOR

Refer to the circuit diagram 13422 (4 Sheets) in Section 8. The Digital Display is used to convert the analog signal developed by the instrument into digital form for readout using 7 segment LED's. In addition, it generates a Binary Coded Decimal (BCD) signal, which can be used with data acquisition systems or the IEEE Standard Digital Interface for Programmable Instrumentation. In this instrument, the analog to digital (A to D) process is performed by a successive approximation method for high speed operation. For display purpose, the internal analog voltage of 1.0 volt corresponds to a decimal output of 1000.

For descriptive purposes, the Digital Display unit can be broken down into five functional elements.

The "Absolute Value Circuit" converts signals of either polarity from the Sample and Hold circuit into a negative voltage signal and a sign bit signal. It also isolates the rest of the instrument from noise generated in the digitizing process.

The "Reference Voltage Supply" which provides a stable standard of reference for comparison with the input analog signal in the A to D circuit. It also provides the necessary offset voltage so the diode switches in the approximation circuit can be turned on and off by TTL level signals.

The "Approximation Circuit", which successively increments the current through the precision resistor network until it balances the current supplied by the input signal through the absolute value circuit.

The "Comparator", which generates a control signal for the Approximation Circuit.

The "Logic Control Circuit" which provides the control information to enable an orderly and sequential conversion process.

In the Pacific Measurements' Digital Display, the process of approximation is carried out in a BCD sequence, starting from the most significant digit. The information is retained in four BCD counters. At the start of each conversion process, the decimal counters are set to 0999. The decimal counter units' (DCU's) states are determined successively from the most significant digit to the least significant. The final answer in the Digital Display has an accuracy of ± 1/2 LSB (least significant bit). For each decade, the numbers from zero to nine are formed as an appropriate combination of binary weighted numbers 1, 2, 4, and 8.

In order to form the 4 digit display, a total of fifteen BCD bits is required. The approximation circuit consists of 15 precision resistors connected to 15 diode switches. The other end of each diode is tied to a common point leading to the comparator input. If a switch is activated, it will supply a precise amount of current corresponding to its bit position. Each switching diode is controlled by the digital output of the BCD counters. Whenever the current supplied by the resistor network is less than the current required by the input signal, the comparator output will be high and the currently active BCD counter will be incremented, which will then actuate the corresponding switches for additional current through the resistor network. Vice-versa, when the current through the resistor network is greater than the current required by the input signal, the comparator output will be low, and the incrementing BCD counter will stop counting and retain the correct digital information.

5.5.1 ABSOLUTE VALUE CIRCUIT (Sheet 3)

Since the approximation process operates in one direction only, the input signals of both polarities have to be reconditioned to one polarity only. If a positive voltage is applied to the input of the Digital Display, A3U23A becomes a voltage follower and it applies a positive voltage to A3R41. Transistor A3Q9 is turned on so A3U19B can set the "+" signal line high. Conversely if a negative voltage is applied, diode A3CR5 will not conduct. The output of A3U23C becomes positive and it supplies the current through diode A3CR7 to A3R41 and A3R40. Transistor A3Q9 is turned off so A3U19B can set the "+" signal line low. The differential amplifier A3U23B inverts the input signal, so the voltage applied to A3R48 is always negative.

5.5.2 REFERENCE VOLTAGE SUPPLY

The Reference Voltage Supply is formed by a temperature stable Zener diode A3CR8 and a resistive network consisting of A3R61, A3R62, and A3R64. A3U23D uses the voltage across the Zener diode to obtain the reference for the approximation circuit and A3C25 stabilizes this reference voltage. The diode in the feedback path of A3U23D, A3U25 (pins 11 and 12) compensates for any temperature variation of current through the precision resistor A3R64. The Zener diode A3CR8 and the comparator are referenced off-ground so that TTL level voltages can switch the diode array in the approximation circuit. In order to insure long term stability, the Zener diode

is aged for several days prior to installation. If a replacement Zener is installed, the + Bal pot A3R72 and + F.S. pot A3R61 may have to be readjusted after a few days of operation because during the first few hours of operation, there may be an appreciable voltage change across the Zener diode. Further voltage changes are slight and occur at a very slow rate.

5.5.3 APPROXIMATION CIRCUIT

The approximation circuit consists of an array of precision resistors and diodes in combination, operated as current switches driven from the decimal counters A3U3, A3U9, A3U14 and A3U18 on Sheet 1. When a bit is high, a fixed amount of current will flow to the comparator A3U24 through the corresponding current switch; vice-versa, when it is low, the current will be sinked by the corresponding decimal counter. Very precise resistors, well-matched diode arrays and pots are used in the most significant bits to insure the accuracy of A to D conversion. Outputs via A3J1 are transmitted to the Front Panel Control and Display Circuit.

5.5.4 COMPARATOR

A fast comparator A3U24 monitors the summing of the approximation circuit. Since the input analog signal is always negative at A3R48 and the feedback signal from the approximation circuit is always positive, the comparator will have a negative output voltage if the current supplied by the approximation circuit is greater than the input current, and a positive output voltage if the current supplied by the approximation circuit is less than the input current. The output of the comparator is latched by A3U19A after it has had time to settle; in this way the effect of comparator noise is minimized.

5.5.5 LOGIC CONTROL CIRCUIT

It is necessary to generate control signals which successively let through the incremental current from the approximation circuit, starting with the most significant digit and continuing down through the least significant. On Sheet 1, A3U15A and A3U15B, together with A3R1, A3C2, A3C3, and A3Q1 form the clocking circuit for the system. The clock cycle is approximately 8 µs long. A3U5 and A3U10 form a forty decade state-counter and A3U1 forms the state decoder. A3U3, A3U9, A3U14 and A3U18 are the decimal counter units (DCU's).

When a positive trigger pulse is received by A3U17B (Sheet 2) it resets the state-counter A3U1 to zero, enables the clocking circuit, sets the digital register to 0999, and latches the polarity signal. From count 2 to count 8, the most significant digit will be determined by incrementing the DCU at each clock pulse until the comparator output becomes low. This will disable the clock to DCU until it is started again by a new trigger pulse. At the 9th clock pulse, the next DCU will be reset to 0. From count 10 to count 18, the next significant digit will be determined, and so on. The display will be blanked during the conversion period (approximately 320 µs), to eliminate flicker.

The EXTERNAL TRIGGER signal is clamped between +0.7 V to +4.3 V by A3CR1 & A3CR2. This signal is fed to a Schmitt-trigger One-shot to provide sharp & clean pulses for the Display Trigger circuit. The INTERNAL TRIGGER signal is provided by A3U20 Timer at 4 times a second. During the auto ranging, a new pulse is generated at the end of a conversion by A3U7 until the correct range B has been obtained. The Display can also be triggered by the IEEE Interface Bus signal through A3U12C. During the COARSE ZERO and CALIBRATION modes, the Display is automatically triggered through A3U12D which overrides any other trigger. In order to minimize the effect of chopper noise in the analog signal, the Sample and Hold circuit A3U22 is synchronized with the chopper pulse through an opto-isolator A3U21. At the end of each sample period, the One-shot A3U8 is triggered so it can start the conversion process of the analog signal.

5.5.6 CALIBRATION OSCILLATOR (Sheet 4)

The Calibration Oscillator is located on the same board as the Digital Display logic. The transistor A3Q15 is arranged in a grounded base oscillator circuit around A3L1, with the ac voltage across A3C37 fed back to the emitter to cause oscillation. It feeds the CAL OUTPUT connector through a low pass filter and a 4 dB attenuator in order to get a harmonic free signal and a good source match at the output. The diode A3CR32 rectifies the peak voltage supplied to A3R104, thereby generating a dc voltage proportional to the RF voltage from the oscillator. The Amplifier A3U28 compares this voltage to a stable voltage derived from the Zener diode A3CR31, and supplies just enough current to the emitter of A3Q15 to maintain oscillations at the correct level set by A3R91 (OSC ADJ). This current is turned on by A3Q16 when the control signal CAL ON is high. Diode A3CR30 compensates the circuit for changes in the rectification characteristic of A3CR32 with temperature variation.

5.6 FRONT PANEL CONTROL AND DISPLAY LOGIC

Refer to the circuit diagram 13806 (2 Sheets) in Section 8. This board contains the front panel switches and indicator lamps. The functions of these controls and indicators have already been described in the Control Board circuit description; however this drawing will be useful since it gives the pin numbers for the connectors on the front panel.

5.6.1 THE DISPLAY LOGIC

Sheet 2 of the schematic shows the latches and

drivers for the Digital Display. A5U7 thru 10 are the decoder-drivers for the display. The a thru g outputs refer to the segments of each display. A5U1 is for the sign, and A5U2 thru 5 are the display modules and the decimal point displays.

5.7 DETECTOR MULTIPLEXER, OPTION 01

Refer to the circuit diagram 14109 in Section 8. This board is installed with Option 01, in conjunction with the Multi-Detector Board 13865. This schematic is useful for the connector pin identification information it gives. The function of the controls are described in the Multi-Detector Board description 5.8.

5.8 MULTI-DETECTOR BOARD, OPTION 01

Refer to the circuit description 13865 in Section 8. This board is installed whenever the instrument is equipped with four RF detector inputs on the rear panel. A detector input may be selected manually by the switch on the front panel, or remotely via the IEEE Bus, if this option is installed. All inputs from the RF detectors are selected; RF Power and Common Inputs, Temperature Compensation, Linear Compensation, and High or Low Power Identification. DETECTOR INPUT #2, 3, and 4 can also be adjusted with respect to DETECTOR INPUT #1 to provide balance for these inputs. The switched input is transmitted to the Analog Board.

5.8.1 DETECTOR INPUTS

Relays A12K1, A12K2, A12K3 and A12K4 select DETECTOR INPUT #1, 2, 3 and 4 respectively, together with the common ground. The relay contacts are connected to the floating ground. The relay selects the required detector under the control of multiplexer A12U1, which allows either the front panel or the bus input to be used. When the bus input is selected, A12U1 (16) is LO thus disabling the front panel switch.

5.8.2 HIGH-LOW POWER DETECTOR INDICATION

NAND gates A12U2 decode the detector pad signal; the A12U2 outputs go LO if a low power detector is connected to the instrument.

5.8.3 DETECTOR AND TEMPERATURE COMPENSATION

A12U4 and A12U5 are optical couplers which isolate the circuits around A12U1 and A12U2 from the linear and thermistor compensation switches that, together with the relay contacts, have a floating ground.

5.8.4 DETECTOR INPUT BALANCE

FINE CAL 2, 3 and 4 are adjusted through the rear panel and balance the three inputs against DETECTOR INPUT #1. The transistor-FET pairs are normally off, but one is switched on by U1 to transmit the thermistor and linear correction voltage from the detector selected to the Analog Board.

5.8 THE IEEE INTERFACE BOARD, OPTION 05

Refer to the circuit diagram 13660 (5 Sheets) in Section 8. The IEEE Interface Board is installed as an option when the instrument is to be controlled from a remote location and transmit measured data to the remote location. The instrument has the standard IEEE Bus or GPIB connections. The Model 1045 can operate as a LISTENER and allow the controller to select the mode or function, calibrate and zero the instrument, select a particular range or autoranging, and select an input if four inputs are installed. As a talker the instrument is able to transmit the readings taken back to the controller, or to a printer. When the instrument is addressed remotely the REMOTE lamp on the front panel lights and the front panel controls are disabled. All functions can be controlled remotely except POWER ON, dB OFFSET and dB AUTO REF. The CAL FACTOR can be set locally but this is usually done as a controller processing function.

5.8.1 ADDRESSING THE MODEL 1045 AS A TALKER OR A LISTENER

The LISTEN and TALK Address Selectors are shown on Sheet 3. Switches A11S1 and A11S2 #1 thru #5 set the address as described in paragraph 3.5 in this manual. The switch is open for a '1' and closed for a '0' logic level. The address is recognized by exclusive NOR gates A11U9, A11U10, A11U11 which form the address comparator, whose outputs are all HI when a successful comparison occurs. The address is received on inputs DI01 thru DI08. When an address is recognized, MLA (LISTEN) or MTA (TALK) go HI. Two switches in each block provide these additional functions:

a. CAL FACTOR ON. When open, the CAL FACTOR control on the front panel can be used. When closed this control is disabled.

b. TRIG DISABLE. When closed, the INTERNAL TRIGGER is overridden and the instrument is triggered from the remote controller. The INTERNAL TRIGGER always operates in the COARSE and FINE ZERO modes.

c. TALK ONLY DISABLE. This is closed whenever the instrument is connected to a local printer, and it will only output data. It is not possible to command the instrument remotely.

d. SRQ ENABLE. When this switch is open the instrument will transmit a service request on the bus when data is ready.

5.8.2 COMMANDING THE INSTRUMENT AS A LISTENER

A11U22 on Sheet 2 is a 4-bit binary to 16 output decoder, which takes commands from Data In-

put/Output DI01 thru DI04 and selects the appropriate output. A11U42, A11U43 and A11U44 latch this data and feed them to the Control Board via A7J2. Note that there are seventeen outputs; the TRIG AUTO ZERO is not latched but taken directly from the decoder. There are three additional latches, A11U1B, A11U41A and A11U41B, which maintain the outputs to functions NOISE FILTER, AUTO ZERO, LINEAR AUTO and RANGE HOLD until they are disabled.

5.8.3 REMOTE/CLEAR (Sheet 2)

These functions are generated from the bus inputs. IFC, Interface Clear, is gated by A11U30A. The other input to pin 4 of this gate generates a clear at POWER ON. Pin 6 goes HI, inverted by A11U13D (10) which is the CLRN signal. This is AND'ed at A11U40C with the REM, Remote signal which resets the binary to decimal decoder. A11U22, A11U19B and A11U19C clock the latches after a short delay due to A11C4, A11R16 and A11R17. Similarly, REN, Remote Enable, Sheet 4, is inverted by A11U14D, and gated to A11U49B which latches the remote function. The output from this latch resets A11U22 as described for CLRN above. The output also is transmitted via A7J3 to disable the front panel controls.

5.8.4 HANDSHAKE CONTROLS FOR DATA ACCEPTANCE (Sheet 2)

The timing sequence for data acceptance is fully described in IEEE STD 488 Appendix B. These signals are shaped by A11U6 and latched by A11U7.

5.8.5 HANDSHAKE FOR DATA TRANSMISSION (Sheet 1)

The inputs via A7J3 are the data in BCD form from the A-D Converter, which is the same signal that drives the Digital Display on the front panel. There are 15 inputs for four digits since the most significant digit only goes to seven and only three BCD lines are required. These inputs are multiplexed as follows:

a. A11U35 and A11U36 select the range, high or low.

b. A11U37 outputs the decimal point and range code corresponding to the designator µW or mW.

c. A11U21 outputs the carriage return and line feed commands.

d. A11U5A and A11U5B; A11U4B and A11U4C; A11U18A and A11U18B encode the sign, and the dB/dBm enunciator for the bus.

e. A11U15A, A11U15B, A11U15C, A11U15D and A11U15F output "," and "-".

The data is driven out onto the bus via A11U5, A11U25, and A11U45 on sheet 5.

5.8.6 DATA OUTPUT CONTROL (Sheet 1)

There are nine bytes of data transmitted plus one byte each for the carriage return and line feed. This sequence is controlled by the state decoder A11U17. The RF BLANKING INPUT is LO for 400 microseconds during the A-to-D conversion; at the end of this period the bistable A11U1A is clocked and the state counter driven by the clock A11U16A which advances each time a byte is received by the controller. A11U17 selects each of the bytes in sequence.

5.8.7 SERVICE REQUEST OUTPUT (Sheet 5)

If the instrument is not being addressed as a talker, TALKER ADDRESS (TAD) is false. The instrument must request service at the output of A11U27B through A11U12D. A11U23B and A11U23C also forms a bistable and is set which sets D107 HI through A11U25A. In response to this service request the controller will transmit a Serial Poll Enable (SPE) which is latched and clocked at A11U27A, causing the instrument to go into the Serial Poll mode. The controller then addresses the instrument as a talker TADN gating A11U26A, which results in the Serial Poll Action (SPA) state, which clears A11U27B and the SRQ signal. A11U23B and A11U23C is also cleared which sends DI07 LO. The controller matches the $\overline{\text{TACN}}$ signal with the address it has just transmitted, and identifies the instrument on the bus with data ready to transmit.

5.8.8 DETECTOR SELECTION (Sheet 5)

DETECTOR INPUTS I1, 2, 3, and 4 from the bus are applied to U52. This decodes the detector selected, which is latched by A11U54. One output DET 1, 2, 3, or 4 becomes true, and this detector input is measured.

5.8.9 DATA OUTPUT (Sheet 5)

The inverters and drivers A11U5, A11U24, A11U25, and A11U45 take the prepared and drive it out on the bus to the controller.

SECTION 6

MAINTENANCE

6.1 PERIODIC MAINTENANCE

The following maintenance should be performed once a year unless the instrument is operated in an extremely dirty or chemically contaminated environment or is subjected to severe abuse. In such cases more frequent maintenance is indicated.

a. Blow out all accumulated dust with forced air under moderate pressure.

b. Inspect the instrument for loose wires and damaged components. Check to see that all wire leads are properly seated on their PC board pins.

c. Make a performance check in accordance with the procedure of Section 3. If the performance is within specifications no further service is required.

6.2 INTERNAL ADJUSTMENTS AND TEST POINTS

The following is a list of adjustments and test points supplied for ready reference. *Do not attempt to make any adjustments until you have carefully read the material of Section 6.3.*

NOTE

Allow a 1 hour warm-up period before performing these adjustments.

6.2.1 DESCRIPTION OF ADJUSTMENTS

The function of each adjustment is described below.

a. A1R83, CAL FACTOR ADJUSTMENT. Sets range of CAL FACTOR control.

b. A2C5, CHOPPER BALANCE. Minimize low level chopper noise.

c. A2R61, SECOND STAGE NULL. Sets output of LOG amp to zero for zero input.

d. A2R68, COMP AMP GAIN. Sets proper tracking at -10 dBm.

e. A2R73, MED. LEVEL CAL. Sets proper tracking at 0 dBm.

f. A2R89, HI LEVEL COMP. Sets proper tracking at +10 dBm.

g. A2R92, LOG CAL. Sets LOG gain for 100 mv/dB.

h. A2R117, dBm REF ADJ. Sets output of isolation amp to zero volts for -10 dBm input.

i. A2R125, -10 V REF ADJ. Sets -10 volt supply.

j. A2R127, +10 V REF ADJ. Sets +10 volt supply.

k. A2R145, -12 V REF ADJ. Sets -12 volt supply.

l. A2R159, +12 V REF ADJ. Sets +12 volt supply.

m. A2R167, AUTO ZERO ADJ. Balances offsets in auto zero loop.

n. A2R212, AUTO dB OFFSET. Sets AUTO dB REF to 0 dB.

o. A2R216, LINEAR GAIN. Sets gain of antilog amplifier.

p. A2R219, LINEARITY. Sets gain of antilog amp.

q. A2R232, LINEAR ZERO. Sets offset of antilog post amplifier.

r. A2R255, OFFSET NULL. Sets offset amp summing junction to 0 volts.

s. A3R29, S/H OFFSET. Zero adj. for Sample and Hold amplifier.

t. A3R36, -F.S. ADJ. Set gain of inverting amp.

u. A3R44, -BAL. Zero adjust for inverting amp.

v. A3R61, +F.S. ADJ. Sets reference voltage for D/A conv.

w. A3R66, 40 ADJ. Sets size of the 40 step of D/A conv.

x. A3R69, 20 ADJ. Sets size of the 20 step conv.

y. A3R72, +BAL. Overall zero adjust.

z. A3R91, OSC ADJ. Set 10 mW power level of calibrator.

a.a. A4R1, +15 V ADJ. Sets +15 volt supply.

a.b. A4R6, -15 V ADJ. Sets -15 volt supply.

a.c. A4R10, +15 V ISOL. ADJ. Sets +15 volt isolated supply.

a.d. A4R14, -15 V ISOL. ADJ. Sets -15 volt isolated supply.

6.2.2 DESCRIPTION OF TEST POINTS

The signal available at each test point or its function is described below.

a. No test points on A1.

b. A2J1 (TP201). DETECTOR VOLTAGE.

c. A2J2 (TP202). DETECTOR COMMON AND ISOLATED COMMON.

d. A2J3 (TP203). PREAMP OUTPUT.

e. A2J4 (TP204). CHOPPER FREQUENCY.

f. A2J5 (TP205). +15 VOLTS ISOLATED.

g. A2J7 (TP206). -15 VOLTS ISOLATED.

h. A2J8 (TP208). LOG AMP SUMMING JUNCTION.

i. A2J9 (TP208). +10 VOLTS.

j. A2J10 (TP208). -10 VOLTS.

k. A2J11 (TP208). +12 VOLTS.

l. A2J12 (TP208). -12 VOLTS.

m. A2J13 (TP208). OVEN CURRENT (1/2 A/VOLT).

n. A2J16 (TP208). ISOLATION AMP OUTPUT.

o. A2J17 (TP208). +15 VOLTS.

p. A2J18 (TP208). 15 VOLT COMMON.

q. A2J19 (TP208). -15 VOLTS.

r. A2J20 (TP208). SUMMING AMP OUTPUT.

s. A2J21 (TP208). ANTILOG AMP OUTPUT.

t. A2J22 (TP208). DPM INPUT.

u. A2J24 (TP224). SUMMING AMPLIFIER SUMMING JUNCTION.

v. A3J1 (TP301). +5 VOLTS.

w. A3J2 (TP301). CLOCK.

x. A3J3 (TP301). $\overline{\text{NEW DATA}}$

y. A3J4 (TP301). 5 VOLT COMMON.

z. A3J5 (TP301). DPM INPUT COMMON.

a.a. A3J6 (TP301). S/H OUTPUT.

a.b. A3J7 (TP301). DPM PREAMP OUTPUT.

a.c. A3J8 (TP301). DPM REFERENCE COMMON.

a.d. A3J9 (TP309). CALIBRATOR CONTROL AMP OUTPUT.

a.e. A4J2 (TP402). +15 VOLTS.

a.f. A4J3 (TP402). 15 VOLT COMMON.

a.g. A4J4 (TP402). -15 VOLTS.

a.h. A4J5 (TP402). +5 VOLTS.

a.i. A4J6 (TP402). +15 VOLTS ISOLATED.

a.j. A4J7 (TP402). 15 VOLT ISOLATED COMMON.

a.k. A4J8 (TP408). -15 VOLTS ISOLATED.

6.3 CALIBRATION

The item numbers that are in parenthesis refer to the callouts in Figure 3-1.

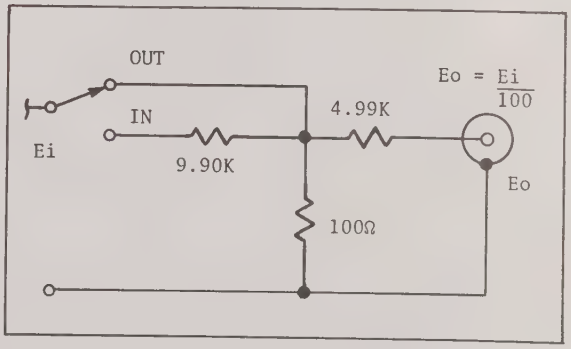
6.3.1 EQUIPMENT REQUIRED FOR CALIBRATION

a. DVM 4 1/2 digit, 1 μV resolution with an accuracy of ± 0.002%.

b. Frequency Counter with 4 digit resolution to measure 1 kHz to 30 MHz.

c. Precision power supply (digital) able to supply up to 20 V and 10 ma. At 100 mV, must have 4 digit resolution and an accuracy of ± 0.03%

d. DC attenuator for the supply in c above, as shown with 0.01% resistors.



DC ATTENUATOR WITH A DIVISION RATIO OF 100

FIGURE 6-1

e. Device to measure 30 MHz with an accuracy of ± 0.5% (Fluke A55 Thermal Converter or equivalent).

f. Calibration Fixture PM part # 14194.

g. Low power detector, shown in Table 1-1.

6.3.2 CALIBRATION PROCEDURE

NOTE

First check the levels and indications, and

only adjust where these are out of tolerance.

a. POWER SUPPLIES (Board A4).

1. Check the unregulated -15 V supply at A4C3 as follows for a line voltage of 115 V.

LINE VOLTAGE JUMPER SETTING	APPROXIMATE VOLTAGE AT A4C3
100	31 V
120	26 V
220	14 V
240	12 V

2. Check the +15 Vdc at TP402 (+) and TP403 (common). Adjust A4R1 for +15 V ± 20 mV.

3. Check the -15 Vdc at TP404 (-) and TP403 (common). Adjust A4R6 for -15 V ± 20 mV.

4. Check +15 V (isolated) at TP406 (+) and TP407 (common). Adjust A4R10 for +15 V ± 20 mV.

5. Check -15 V (isolated) at TP408 (-) and TP407 (common). Adjust A4R14 for -15 V ± 20 mV.

6. Check the 5 V LOGIC SUPPLY. TP405 (+) and TP407 (common). Check for 5 V ±0.25 V.

b. READOUT (Board A3).

1. Select TEST position of A3S1.

2. Connect the precision power supply to TP311 with Low side to TP305. The Low side should be grounded.

3. Switch TRIGGER to INTERNAL on rear panel and connect the DVM from TP306 to TP305 (Low).

4. Momentarily short test points SEG TEST to COM (Mother Board A1) and note DPM reads 88.88. With precision supply set to zero volts, adjust S/H OFFSET A3R29 for zero volts ±0.2 mV at TP306. Disconnect the DVM.

5. Apply +10 mV and adjust +BAL A3R72 for a reading of +00.10 on DPM.

6. Apply -10 mV and adjust -BAL A3R44 for a reading of -00.10 on DPM.

7. Apply +1.000 volts and adjust +F.S. A4R61 for a reading of 10.00 on DPM.

8. Apply +2.01 volts and adjust 20 ADJ A4R69 for a reading of 20.10 on DPM.

9. Apply +4.01 volts and adjust 40 ADJ A4R66 for a reading of 40.10 on DPM.

10. Apply +7.01 volts and adjust +F.S. A4R61 for a reading of +70.10 on the DPM.

11. Apply -7.01 volts and adjust -F.S. A3R36 for a reading of -70.10 on the DPM.

12. Repeat steps 5 thru 11.

13. Check each digit for all numbers by applying a voltage corresponding to the value of each digit.

14. Note if the O.R. light goes on at 7000.

15. Disconnect the precision power supply and select the SYNC position of A3S1.

c. ANALOG (Board A2)

1. Connect the detector input using the 14194 fixture to the precision power supply and set the voltage to zero. Use the dc attenuator and set the switch to "IN".

2. Check the voltage at TP213 at turn on. It should be approximately -13.5 V. Watch for approximately a minute to see that it stabilizes at approximately -14.9 volts. Note: Use TP202 for low side of voltage measurements.

3. Check the +10 V at TP209 (+) and TP218 (common). Adjust A2R121 for +10 V ± 1 mV.

4. Check the -10 V at TP210 (-) and TP218 (common). Adjust A2R125 for -10 V ± 1 mV.

5. Check the +12 V at TP211 (+) and TP202 (common). Adjust A2R159 for +12 V ± 1 mV.

6. Check the -12 V at TP212 (-) and TP202 (common). Adjust A2R145 for -12 V ± 1 mV.

7. Check chopper frequency at TP204 for 1 KHz ± 100 Hz.

8. Set the detector input voltage to 0 with attenuator switch "IN". Select COARSE ZERO. Measure voltage at TP203. Set front panel COARSE ZERO (18) for -30 μ volts ± 10 μV. Set A2R61 (SEC-

OND STAGE BAL) for center scale reading on Relative Power meter. Press FINE ZERO (21) and note that COARSE ZERO LED goes off for approximately 4 seconds.

9. Set the detector input voltage to -0.228 volts with attenuator switch "OUT" and note the voltage at TP203 = 2.90 to 2.96 V.

10. Set the detector input voltage to -0.007 volts with attenuator switch "IN" and adjust CHOPPER BAL A2C5 for minimum amplitude 1 KHz at TP216 (approximately 20 mV P.P.).

11. Set the detector input voltage to 0 with attenuator switch "IN" and apply -150 mV to TP208. Adjust A2R117 (dBm ADJ) for zero volts ± 1 mV at TP216. Move low side of DVM from TP212 to TP218.

12. Apply -.015 V to TP208 and adjust A2R92 (LOG CAL) for -1.00 volts ± 2 mV. Apply 1.5 mV and note that the voltage at TP216 is -2.00 volts ± 10 mV. If not, reset A2R167, apply 0 volts, press FINE ZERO and repeat steps 11 & 12. Disconnect the precision supply.

13. Set detector input voltage to 0 with attenuator switch "IN" and press FINE ZERO. Set detector input voltage to -0.070 volts with attenuator switch "IN" and adjust A2R117 (dBm ADJ) for -2.00 volts ± 1 mV at TP216.

14. Set detector input voltage to -0.228 volts with attenuator switch "OUT" and adjust A2R73 (MED LEVEL) for +1.00 volts ± 1 mV at TP216.

15. Set detector input voltage to -0.0486 volts with attenuator switch "OUT" and adjust A2R68 (COMP AMP GAIN) for 0.00 volts ± 1 mV at TP216. Repeat steps 14 & 15 as required.

16. Set detector input voltage to -0.850 volts with attenuator "OUT" and adjust A2R89 (HIGH LEVEL COMP) for -2.00 volts ± 1 mV at TP216.

17. Repeat steps 14-17 as required.

18. Measure the voltages at TP224 with respect to TP218. Adjust A2R255 for zero volts + 200 µV.

19. Connect the DVM to the ANALOG OUTPUT (36).

20. Set detector input voltage to -0.228 volts with attenuator switch "OUT", and adjust the front panel CAL pot (19) for zero volts ± 1 mV at the ANALOG OUTPUT.

21. Set detector input voltage to 0 with attenuator switch "IN". Press FINE ZERO and wait 5 seconds.

22. Set detector input voltage to -0.070 volts with attenuator switch "IN" and adjust A2R222 (dB GAIN) for -3.00 volts ± 1 mV. Disconnect the DVM from the ANALOG OUTPUT.

23. Set detector input voltage to -0.228 volts with attenuator switch "OUT". Adjust the front panel CAL control (19) for a reading of 00.00 dBm on the display. Select LINEAR MANUAL mode (6). Select 1 mW scale (9). Adjust A2R126 LINEAR GAIN for 1.000 mW ± 0.002 mW on the display.

24. Set the detector input voltage to -0.5 volts with the attenuator switch "OUT". (Be sure the supply is grounded.)

25. Note the reading on the display. It should be very near 3.9 mW. Select the 10 mW scale (9) and adjust A2R219 (LINEARITY) for exactly the same reading as obtained on the 1 mW scale (at 1/10 the resolution).

26. Set the detector input voltage to 0 V with attenuator switch "IN". Select 1 mW range (9). Adjust A2R232 (LINEAR ZERO) for 0.000 mW on readout.

27. Repeat steps 23-26 as required.

28. Set MODE switch to LOG (6) and select the dBm mode. Set the detector input voltage to -0.228 volts with attenuator switch "OUT". With CAL FACTOR (11) set to 0, set the front panel CAL control (19) for a reading of 00.00 dBm.

29. Set the CAL FACTOR (11) to +1.0 dB and adjust A2R83 (CAL FACTOR ADJ) for 01.00 dBm ± 0.01 dB.

30. Set the CAL FACTOR (11) to -1.0 dB and note the reading on the readout. It should be -01.00 dBm. Reset A2R83 for the best compromise readings at each end of the CAL FACTOR dial.

31. Select LOG, dB MANUAL REF mode (7) and verify that the range of the dB MANUAL REF control is < -10 to > +50 dB (so that any input from +10 dBm to -50 dBm can be set to 0 dB).

32. Connect a DVM to the ANALOG OUTPUT (36). Adjust the dB MANUAL REF control (15) for zero volts at the output.

33. Select the LOG, dB OFFSET mode (7). Set the dB OFFSET control (15) for 00.00 dB on the display. If the ANALOG OUTPUT is not zero volts ± 1 mV, set it with the dB MANUAL REF control. Then lock the dB MANUAL REF control.

34. Rotate the dB OFFSET control (15) full CW. The readout must indicate > -60 dB.

35. Rotate the dB OFFSET control (15) full CCW. The readout must indicate > +60 dB.

36. Set the dB OFFSET control (15) for exactly +60.00 dB on the readout and note that the ANALOG OUTPUT is -6.00 volts ± 12 mV.

37. Select LOG, dB AUTO REF mode and press the dB AUTO REF button. If the readout does not indicate 00.00 dB ± 0.03 dB, adjust A2R212 (AUTO dB OFFSET) while repeatedly pressing the dB AUTO REF button, until the readout indicates 00.00 dB ± .01 dB.

38. Select the LOG, dBm mode (7). Set the detector input voltage to approximately -0.9 volts with attenuator switch "OUT", adjust this voltage up or down until the OR light comes on. The readout must indicate < 10.8 dBm.

39. Set the detector input voltage to -0.228 volts with attenuator switch "OUT". Press the detector I.D. button on the Calibration Fixture # 14194 and note the reading increases 30.00 dB ± 03 dB.

40. Select 1 mW mode (9). Press the detector I.D. button and note the scale indicator changes from mW to W. Also note the yellow LED indicator over the linear scale switch changes from low power to high power scale (8).

41. Set the detector input voltage to -0.007 volts with attenuator switch "IN," and select the LINEAR AUTO mode (6). Note the reduction in readout noise when the NOISE FILTER is turned on. Press the detector I.D. button and note the scale indicator changes from µW to mW.

42. Select the LOG mode (6). Connect the PM detector and Model 1045 in place of the # 14194 fixture. Apply 0 dBm at 30 MHz; readout should be approximately 00.00 dBm. Select dB MANUAL REF mode (7). Connect the precision supply without the attenuator to the RATIO INPUT (35). Set the supply to 0 V and adjust the dB MANUAL REF control for 00.00 dB on the display.

43. Set the precision power supply to +6.00 volts. The display should indicate -60.00 dB ± .12 dB. This checks the operation of the RATIO INPUT. Remove the precision supply.

44. Remove the RF from the detector input. Measure the voltage at the RF BLANKING OUTPUT (34). It should indicate between +2.4 and +5.2 volts.

45. Press FINE ZERO (21). The RF BLANKING OUTPUT should drop to < 0.4 volts for approximately 3 seconds and return to its previous value.

END OF TEST.

6.4 TROUBLE SHOOTING

In order to localize the source of trouble in an instrument such as this you must have a detailed working knowledge of the instrument. You are urged to read Section 5, Circuit Description and to make use of the circuit diagrams found in Section 8. Relevant dc voltages are shown on the schematic diagrams and are typical of values to be found during normal operation. The data was taken with a digital voltmeter with 10 MΩ input impedance. The front panel controls were set as follows:

POWER	ON
RANGE	CAL
CALIBRATION FACTOR	CENTERED (0)

The detector was connected to the CALIBRATOR OUTPUT and the CAL control set so the meter reads full-scale.

The only significant ac signals in the instrument are those in the chopper circuit. A timing diagram for these signals is shown in Figure 6-2.

6.5 SEMICONDUCTOR DEVICES

A variety of semiconductor devices are used in this instrument. The type numbers shown are either EIA registered device numbers or manufacturer's numbers. Devices meeting the corresponding specifications can be used for replacement purposes and can probably be obtained locally. Individual instruments may have equivalent devices of other manufacturers installed and the type number may not agree with those shown on the schematic diagram or parts list.

6.6 ACCESS TO INTERNAL COMPONENTS

To gain access to internal components, remove the six screws on each of the top and bottom covers. The unit must be removed from the rack

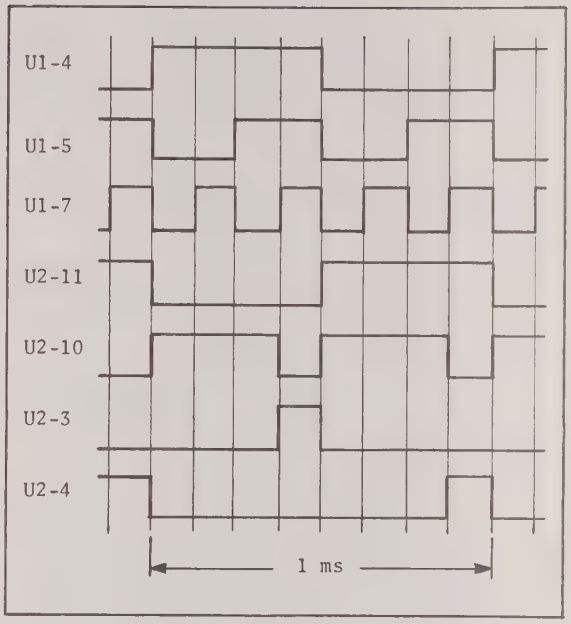
if it is rack-mounted.

6.6.1 ACCESS TO PARTS ON THE FRONT PANEL

To gain access to the front panel components, remove the eight screws at the top and bottom edges of the panel. Carefully pull the panel straight out from the rest of the instrument. Remove the nine screws holding the circuit board to the panel and carefully rest the board.

6.6.2 ACCESS TO PLUG-IN PRINTED CIRCUIT BOARDS

To gain access to the plug-in printed circuit boards, lift the instrument onto its side and from the bottom remove the two screws on each card cage. Swing the card cage out and remove the five screws holding each card cage cover.



CHOPPER CIRCUIT TIMING

FIGURE 6-2

SECTION 7

INTERFACE BUS, OPTION 05 (IEEE 488-1975)

7.1 CONTROLLING THE MODEL 1045 FROM A REMOTE LOCATION

When the IEEE Interface Board (Option 05) is installed it is possible to select the mode of operation and receive measured data from the Model 1045. A remote controller can be connected to several units on the same bus. The circuit description for the IEEE Interface Board should be studied for details of the operation of this feature; this section describes the program inputs required to operate the instrument remotely.

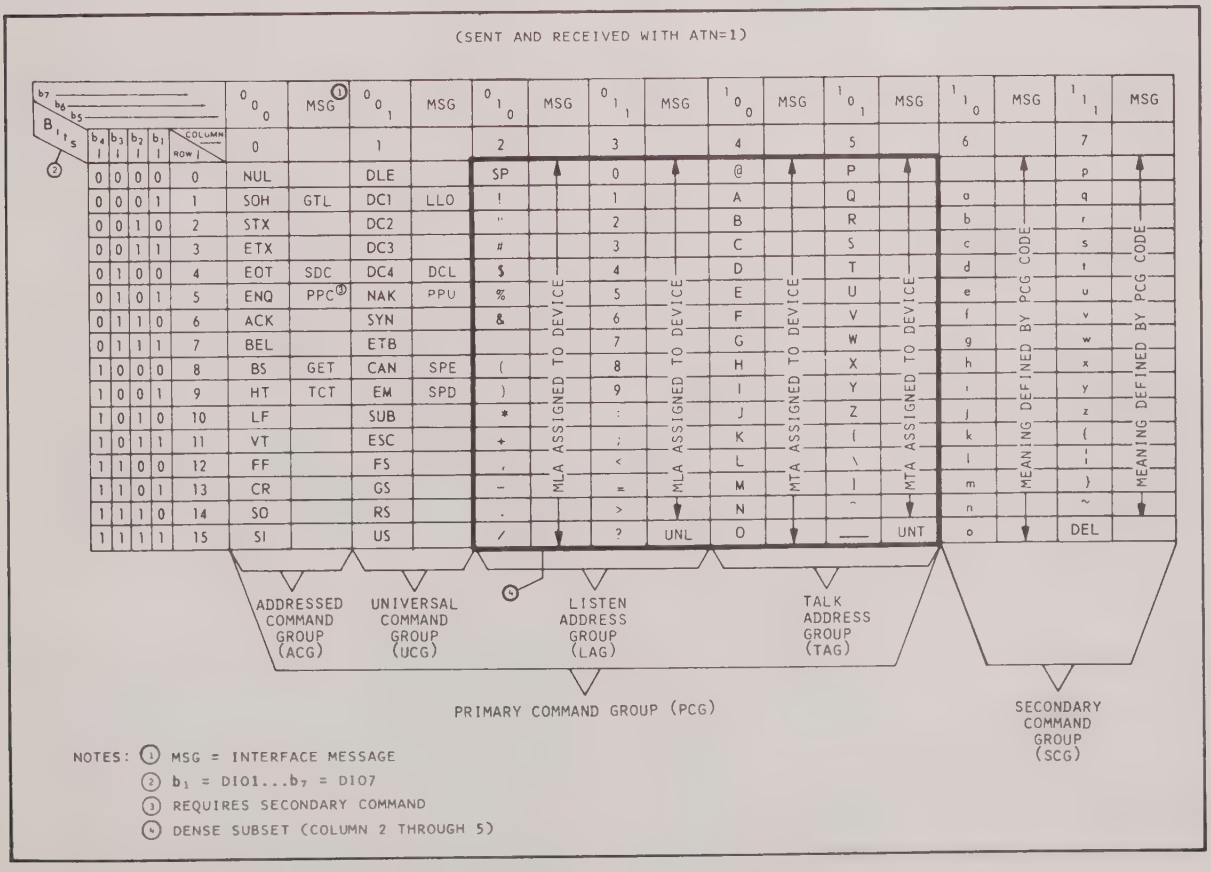
When the control function is assumed at the remote location, the REMOTE lamp on the front panel lights and all front panel controls except POWER ON and OFF are disabled. All other functions can be controlled remotely except dB MANUAL REF and dB OFFSET. SRQ ENABLE, TRIG DISABLE, TALK ONLY OFF and CAL FACTOR must be set locally before the instrument is selected for remote operation. This is fully described in Section 3. Also the Model 1045 has two switch arrays to set up the LISTEN and TALK ADDRESS to enable the controller to identify the instrument on the bus.

The command and data transmissions are all in Standard ASCII code; a copy of this is shown in Figure 7-1.

7.2 PROGRAMMING THE FUNCTIONS WITH THE INSTRUMENT AS A LISTENER

When the instrument is addressed as a LISTENER, the function, range, and detector (Option 01) is selected by sending the codes that are given in Table 7-2.

If the TRIG DISABLE switch (#6 on the LISTENER ADDRESS switch) is OPEN, the rear panel TRIGGER function is disabled and the triggering must be initiated by one of these methods:


(SENT AND RECEIVED WITH ATN=1)
MLA ASSIGNED TO DEVICE
MTA ASSIGNED TO DEVICE
MEANING DEFINED BY PCG CODE
ADDRESSED COMMAND GROUP (ACG)
UNIVERSAL COMMAND GROUP (UCG)
LISTEN ADDRESS GROUP (LAG)
TALK ADDRESS GROUP (TAG)
PRIMARY COMMAND GROUP (PCG)
SECONDARY COMMAND GROUP (SCG)
NOTES: ① MSG = INTERFACE MESSAGE
② b1 = DIO1...b7 = DIO7
③ REQUIRES SECONDARY COMMAND
④ DENSE SUBSET (COLUMN 2 THROUGH 5)

MULTILINE INTERFACE MESSAGES: ISO-7 BIT CODE REPRESENTATION

FIGURE 7-1

Reproduced from *IEEE Standard 488-1978* by permission of the Institute of Electrical and Electronics Engineers.

a. Transmitting "GET" (Group Execute Trigger), or

b. Transmitting data word "?"

The AUTO ZERO function is latched ON once it has been programmed and at the same time it performs the function of correcting the zero adjustment for the instrument. This takes approximately 3 s, during which no power may be applied to the detector. To allow adjustment of MAN to COARSE ZERO control, "MAN ZERO" must be programmed.

The FILTER ON function is also latched ON once it is programmed, it is returned automatically to OFF by programming the AUTO ZERO function.

To automatically re-zero the instrument to compensate for thermal drift or when another detector has been selected (Option 01 only) follow this procedure:

a. Address the instrument as a listener,

b. Send data character "L",

c. Send data character "M" if the filter is required,

d. Send the Unlisten command "UNL".

The Range function could be locked on in AUTO LINEAR mode by programming the RANGE HOLD function.

To make AUTO dB measurement, first program the dB AUTO (REF) to set the reference at 0 dB, then program the dB AUTO (REL) to get the relative dB from the stored reference.

TABLE 7-2

INSTRUMENT FUNCTIONS AND THEIR CORRESPONDING ASCII CODES

FUNCTION	CODE	FUNCTION	CODE
0.1 µW range	"A"	MAN ZERO	"K"
1 µW range	"B"	AUTO ZERO	"L"
10 µW range	"C"	FILTER ON	"M"
0.1 mW range	"D"	CALIBRATION	"N"
1 mW range	"E"	RANGE HOLD	"O"
10 mW range	"F"	DETECTOR #1	"Ø"
AUTO LINEAR	"G"	DETECTOR #2	"1"
dBm	"H"	DETECTOR #3	"2"
dB AUTO (REF)	"@"	DETECTOR #4	"3"
dB AUTO (REL)	"I"	TRIGGER	"?"
dB MAN	"J"		

With the Multi-detector Option, the DETECTOR #1 is automatically selected on POWER ON or Interface Clear.

7.3 FETCHING DATA FROM THE INSTRUMENT AS A TALKER

When the instrument is addressed as a TALKER, it delivers data in an eleven-byte sequence as follows:

Data	Code	Meaning
$(DAB)_0$	"+"-", " "	polarity/space
$(DAB)_1$	"0" to "7"	most significant digit
$(DAB)_2$	"0" to "9"	2nd digit
$(DAB)_3$	"0" to "9"	3rd digit
$(DAB)_4$	"0" to "9"	least significant digit
$(DAB)_5$	","	delimiter
$(DAB)_6$	"-"	minus
$(DAB)_7$	"2", "3", "4"	exponent of 10
$(DAB)_8$	"!"	Watts
	"#"	mW
	"$"	µW
	"%"	dBm
	"&"	dB
$(DAB)_9$	CR	Carriage Return
$(DAB)_{10}$	LF	Line Feed

7.4 MODEL 1045 MEASURING AND TRANSMITTING SPEED

The instrument can make up to 500 measurements per second, and transmit the measurements at that rate. The routine bus control functions are hardware controlled and consume negligible time. Transmission speed may be limited by the speed at which the remote controller can receive the data.

7.5 SERIAL POLL

When the SRQ ENABLE switch is OPEN, the instrument sends out an SRQ (interrupt) message whenever new data is ready to send but the instrument has not been addressed as a TALKER. The controller then polls all instruments on the bus and locates the one ready to send, and enables it to transmit the data.

7.6 EXAMPLE OF INTERACTIVE PROGRAM FOR 1045 PROGRAMMING

This program can be run without understanding

programming. The user needs only to enter the information requested on the display and the desired measurement data will be delivered on the printer or CRT terminal. The program is written both for HP9825 Calculator and TEK 4051 Graphic Terminal. It shows the complete capability of the 1045 for IEEE Interface applications. For the proper operation the INTERNAL LISTEN ADDRESS switch should be set to 01 and TALK ADDRESS should be set to 02. The "TRIG DISABLE" and "SRQ ENABLE" switches should be OFF. "TALK ONLY OFF" switch should be ON.

The program asks for Detector #, then it will ask for RANGE CODE and output the data. Type Range = Q to reselect detector # and type Range = P to activate Front Panel Control. After adjusting the COARSE ZERO or CAL, hit RETURN key to restart.

In order to interface the 1045 and run the above programs with HP9825, the following configuration should be used:

DESCRIPTION	PRODUCT NO.
Desktop Calculator	9825A
String ROM	98210A
General 1/0 - Extended 1/0 ROM	98213A
HP-1B Interface Card	98034A

EXAMPLE: Using the HP9825 Calculator, let's suppose the LISTEN ADDRESS is set to 01 and the TALKER ADDRESS is set to 02. The following programming statements select the DETECTOR #2; set the dBm function; then trigger the display and read the data:

```
wrt 701, "1H?"
red 702, A$
wrt 16, A$
```

Suppose the RF power input is at 10.02 dBm, then it will print the data on its printer as "+1002,-2%".

Using the TEK 4051 Graphic Terminal, the same program will be written as follows:

```
PRINT @1:  "1H?"
INPUT @2:  A$
PRINT A$
```

7.7 HP 9825 PROGRAM

```
 Ø: dim A$(1), B$(3), D$(1), S$(1), T$(1)

 1: "START":ent "DETECTOR #", S$; num(S$)-1→S;
    char(S)→T$

 2: fmt 3, c1

 3: wrt 7Ø1.3, T$

 4: "LOOP": ent "RANGE =", A$

 5: if A$="Q"; gto "START"

 6: if A$="P"; gto "PANEL"

 7: wrt 7Ø1.3, A$

 8: if A$="K"; gto "CZR"

 9: if A$="N"; gto "CAL"

10: "ENTRY":trg 7Ø1

11: fmt 2, f5, 1x, f2, c1

12: wait 500

13. red 7Ø2.2, B, D, D$

14: B *1Ø↑D→B

15: if D$="!"; "W"→B$; jmp 5

16: if D$="#"; "mW"→B$; jmp 4

17: if D$="$"; "µW"→B$; jmp 3

18: if D$="%"; "dBm"→B$; jmp 2

19: if D$="&"; "dB"→B$

20: fmt 4, "Pwr @ Det #", c1,"=", f8.4, c3,/

21: wrt 16.4, S$,B,B$; gto "LOOP"

22: "PANEL":  dsp "front panel is active"

23: lcl 7Ø1; gto "ENTRY"

24: "CZR":  dsp "turn RF off, adj. COARSE ZERO";
    stp; gto "LOOP"

25: "CAL": dsp "connect CAL OUTPUT, adj. CAL";
    stp; gto "LOOP"

26: end
```

7.8 TEK 4051 PROGRAM

```
4 GO TO 100

100 PRINT "DETECTOR #";

110 INPUT S$

120 S=VAL(S$)-1

130 T$=STR(S)

140 PRINT @1:T$

150 PRINT "RANGE =";

160 INPUT A$

170 IF A$="Q" THEN 100

180 IF A$="P" THEN 460

190 PRINT @1:A$
```

```
200 IF A$="K" THEN 490
210 IF A$="N" THEN 510
220 WBYTE @33,8,63:
230 FOR A=1 TO 100
240 NEXT A
250 INPUT @2:B,C$
260 D$=SEG(C$,2,2)
270 D=VAL(D$)
280 B=B*10↑D
290 D$=SEG(C$,4,1)
300 IF D$="!" THEN 350
310 IF D$="#" THEN 370
320 IF D$="$" THEN 390
330 IF D$="%" THEN 410
340 IF D$="&" THEN 430
350 B$=" W"
360 GO TO 440
370 B$=" MW"
380 GO TO 440
390 B$=" UW"
400 GO TO 440
410 B$=" DBM"
420 GO TO 440
430 B$=" DB"
440 PRINT "PWR @ DET#";S$;"=";B;B$
450 GO TO 150
460 WBYTE @33,1,63:
470 PRINT "FRONT PANEL IS ACTIVE"
480 GO TO 220
490 PRINT "TURN RF OFF, ADJ. COARSE ZERO";
500 GO TO 520
510 PRINT "CONNECT CAL OUTPUT, ADJ. CAL";
520 INPUT A$
530 GO TO 150
540 END
```

7.9 HP 9825 PROGRAM ON SERIAL POLL

```
1Ø:  if bit (7,rds(7)); jmp 2
11:  jmp - 1; dsp "SRQ disabled"; stp
12:  if bit (6,rds(7Ø2)); jmp "DEV#2"
13:  if bit (6,rds (7Ø3)); jmp "DEV#3"
14:  dsp "error"; stp
15:  "DEV#2":  fmt "T addr. of PM1045=",f2
16:  wrt 16.1, T-7ØØ
 |
 |
 |
8Ø:  "DEV#3":
```

7.10 TEK 4051 PROGRAM ON SERIAL POLL

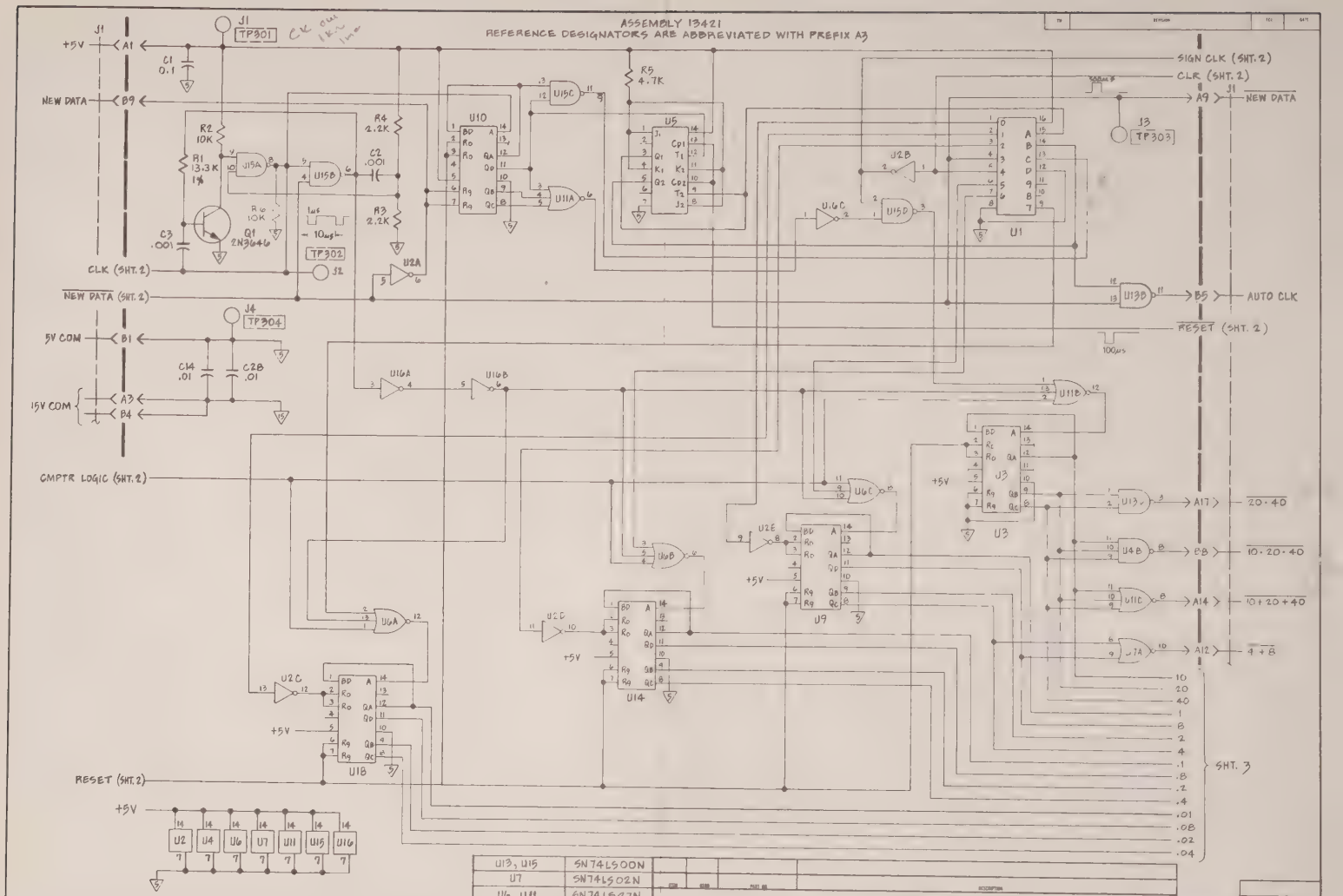
```
150 ON SRQ THEN 190
160 WAIT
170 PRINT "SRQ DISABLED"
180 STOP
190 POLL M,W;2;3
200 GO TO M OF 210, 310
210 PRINT "T ADDR. OF PM1045="; M
 |
 |
 |
310
```

SECTION 8

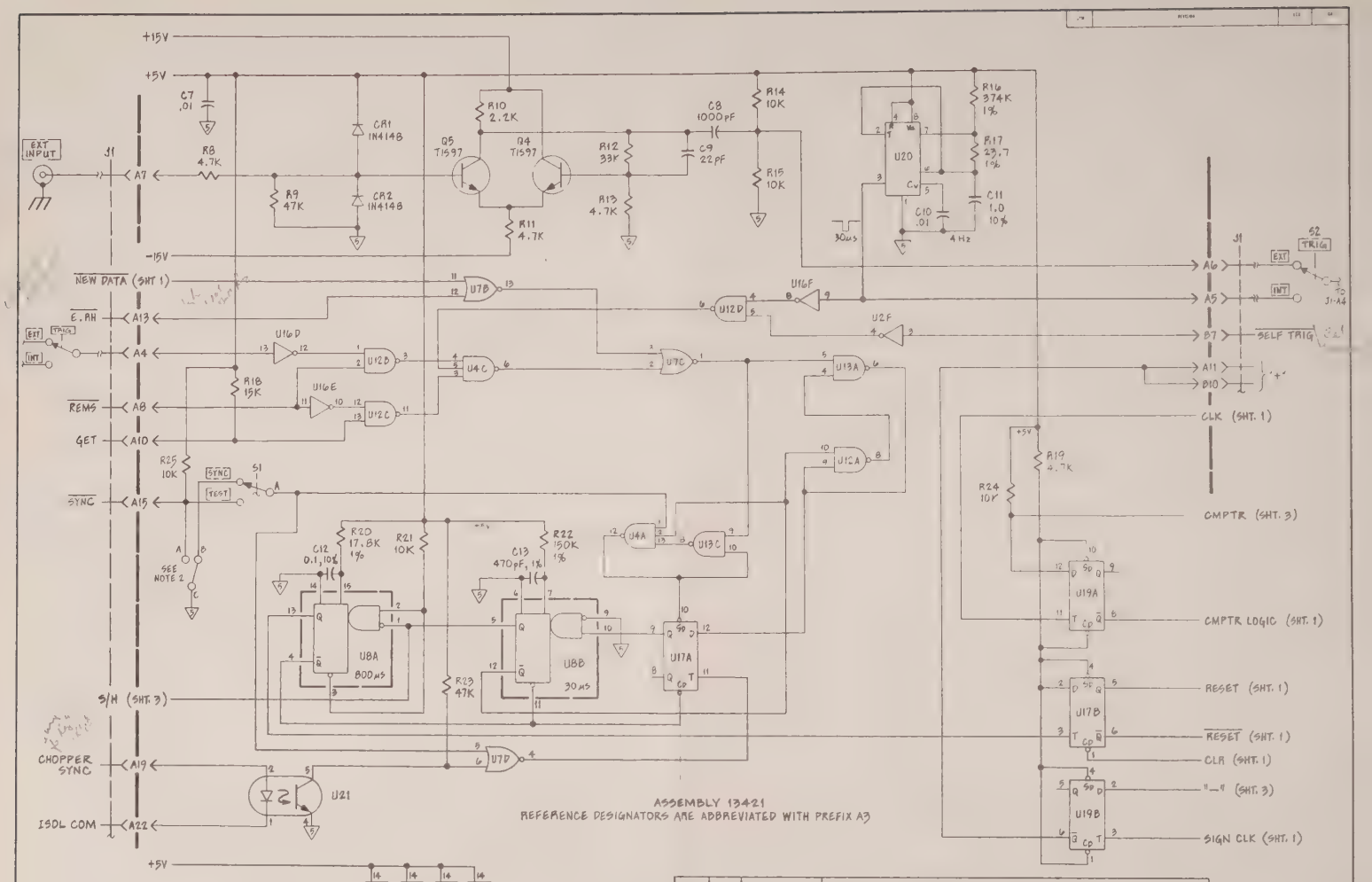
BLOCK AND SCHEMATIC DIAGRAMS

Block and Schematic diagrams in this section are filed in the order of their drawing numbers.

Reference Designator		Drawing Number
----	BLOCK DIAGRAM, RF POWER METER	14239
----	RF POWER METER	13901
A1	CONTROL BOARD (4 SHEETS)	13456
A2	ANALOG BOARD (4 SHEETS)	13510
A3	DISPLAY LOGIC & CALIBRATOR (4 SHEETS)	13422
A4	POWER SUPPLY	13796
A5	FRONT PANEL CONTROL AND DISPLAY CIRCUIT (2 SHEETS)	13806
A7	INTERFACE #1	14069
A8	INTERFACE #2	14070
----	IEEE INTERFACE, OPTION 05	14099
A11	IEEE INTERFACE BOARD (5 SHEETS)	13660
----	DETECTOR MULTIPLEXER, OPTION 01	14109
A12	MULTI-DETECTOR BOARD	13865



REF DESIG	TYPE
U1	SN74LS42N
U2, U16	SN74LS04N
U3, U9, U10, U14, U18	SN74LS90N
U4	SN74LS10N
U5	SN74LS107N
U6, U11	SN74LS27N
U7	SN74LS02N
U13, U15	SN74LS00N



ASSEMBLY 13421
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A3

NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS AND ARE ±5% 1/4W. CAPACITOR VALUES ARE IN MICROFARADS.
2. CHANGE JUMPER TO 'A-B' WHEN HI-LEVEL IS NOT IN SYNC WITH CHOPPER.

REF DESIG	TYPE
U21	FCD 810
U20	LM555CN
U17, U19	SN 74LS74N
U12	SN 74LS00N
U8	SN 74LS123N

LIST OF MATERIAL

NEXT ASSY

DRAWN V.Y.T. 1-25-78
CHK RB 7-11-78

PACIFIC MEASUREMENTS INCORPORATED

DISP_AY LOGIC & CALIBRATOR

DRAWING NO 13422 REV A

SHEET 2 OF 4

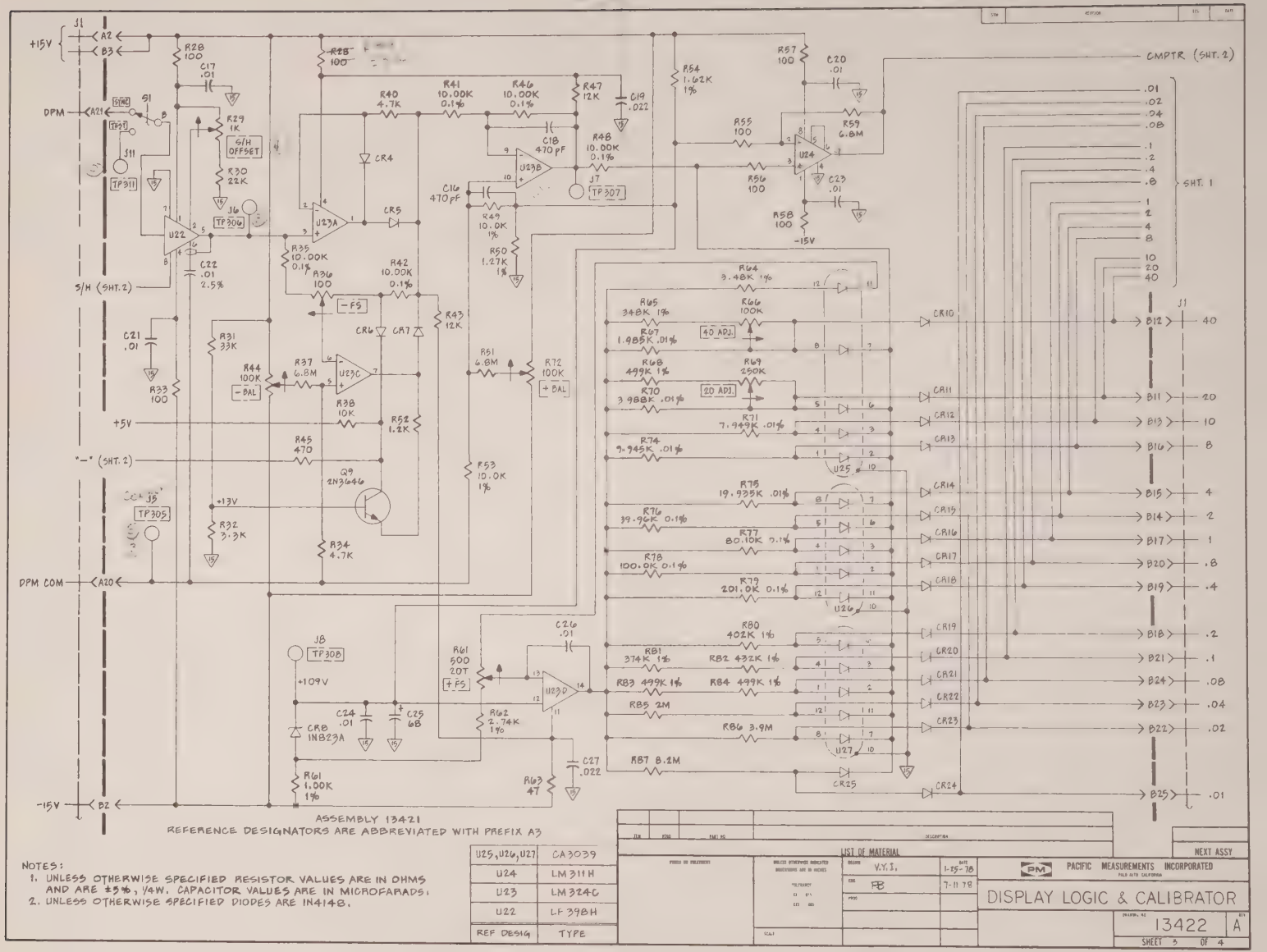
READOUT TESTEST

1 - Select

2 - Cond Supply

3 - Dvm

4 - ON INCRFACE
A



REF DESIG	TYPE
U25, U26, U27	CA3039
U24	LM311H
U23	LM324G
U22	LF398H

NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS AND ARE ±5%, ¼W. CAPACITOR VALUES ARE IN MICROFARADS.
2. UNLESS OTHERWISE SPECIFIED DIODES ARE IN4148.

LIST OF MATERIAL

NEXT ASSY

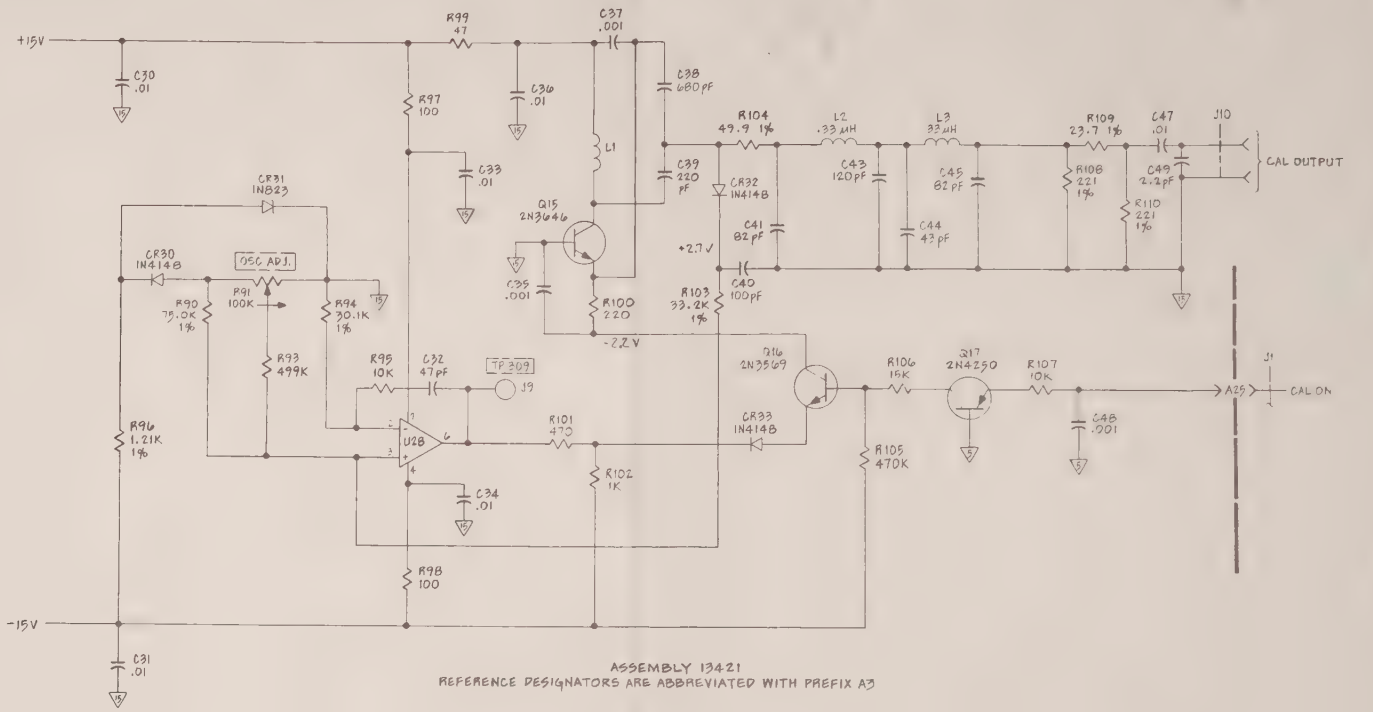
DRAWN	V.Y.S.	1-25-78
CHK	FB	7-11 78
PROJ		

PACIFIC MEASUREMENTS INCORPORATED
PALO ALTO CALIFORNIA

DISPLAY LOGIC & CALIBRATOR

13422 A

SHEET 3 OF 4



ASSEMBLY 13421
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A3

NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS AND ARE ±5% 1/4W. CAPACITOR VALUES ARE IN MICROFARADS.

REF DESIG	TYPE
U2B	LM741C

LIST OF MATERIAL

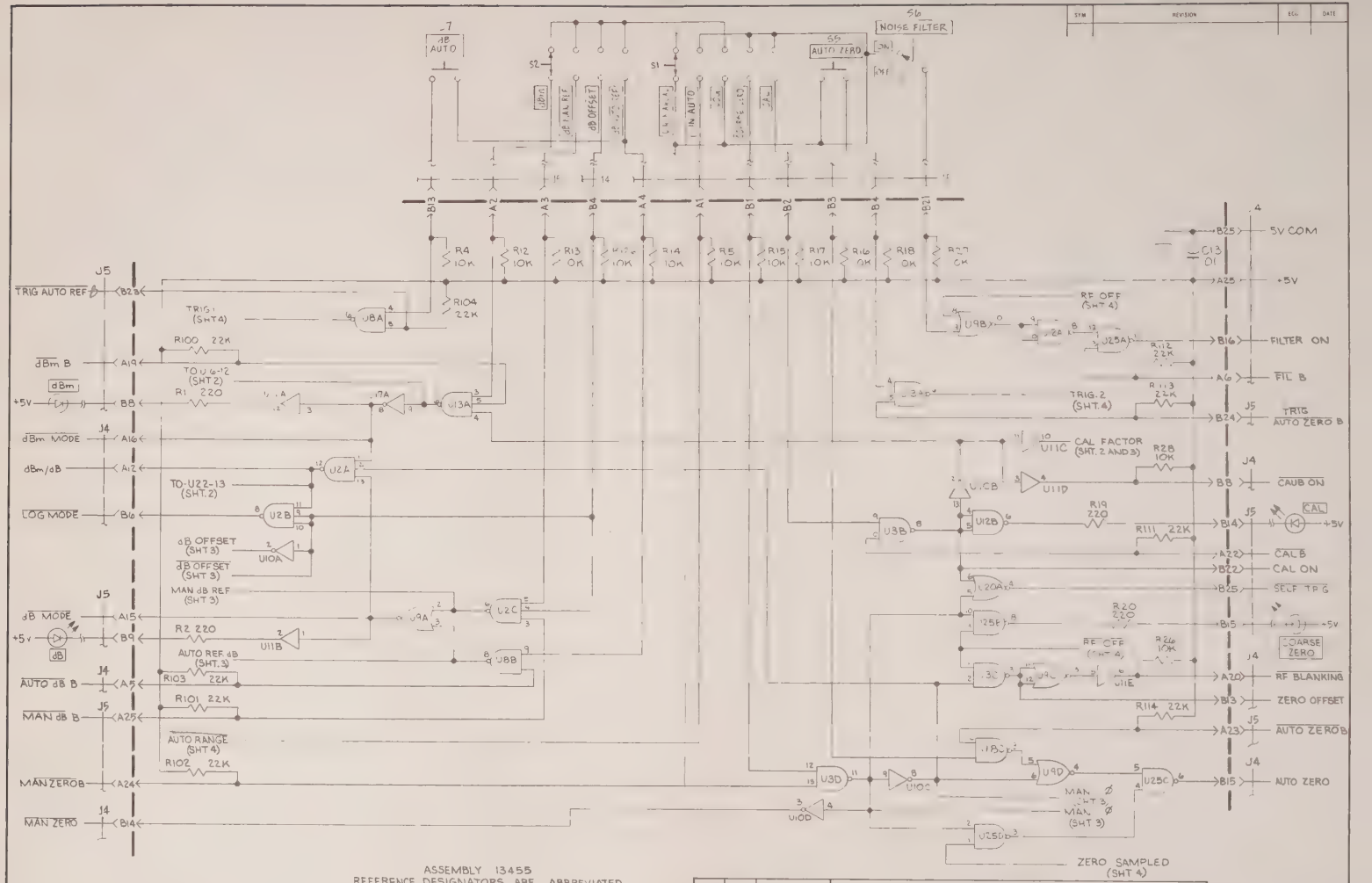
NEXT ASSY

PACIFIC MEASUREMENTS INCORPORATED

DISPLAY LOGIC & CALIBRATOR

DRAWING NO. 13422 REV A

SHEET 4 OF 4



ASSEMBLY 13455
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A1

NOTE:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS AND ARE ¼W ±5%. CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.

REF DES	TYPE
U2, U13	SN74LS10N
U10, U17	SN74LS04N
U9, U20	SN74LS02N
U8, U25	SN74LS00N
U11	SN7407
U3, U12	SN7400N

LIST OF MATERIAL

NEXT ASSY

FINISH OR TREATMENT

UNLESS OTHERWISE INDICATED DIMENSIONS ARE IN INCHES
TOLERANCE
XX - ±15
XXX - ±05

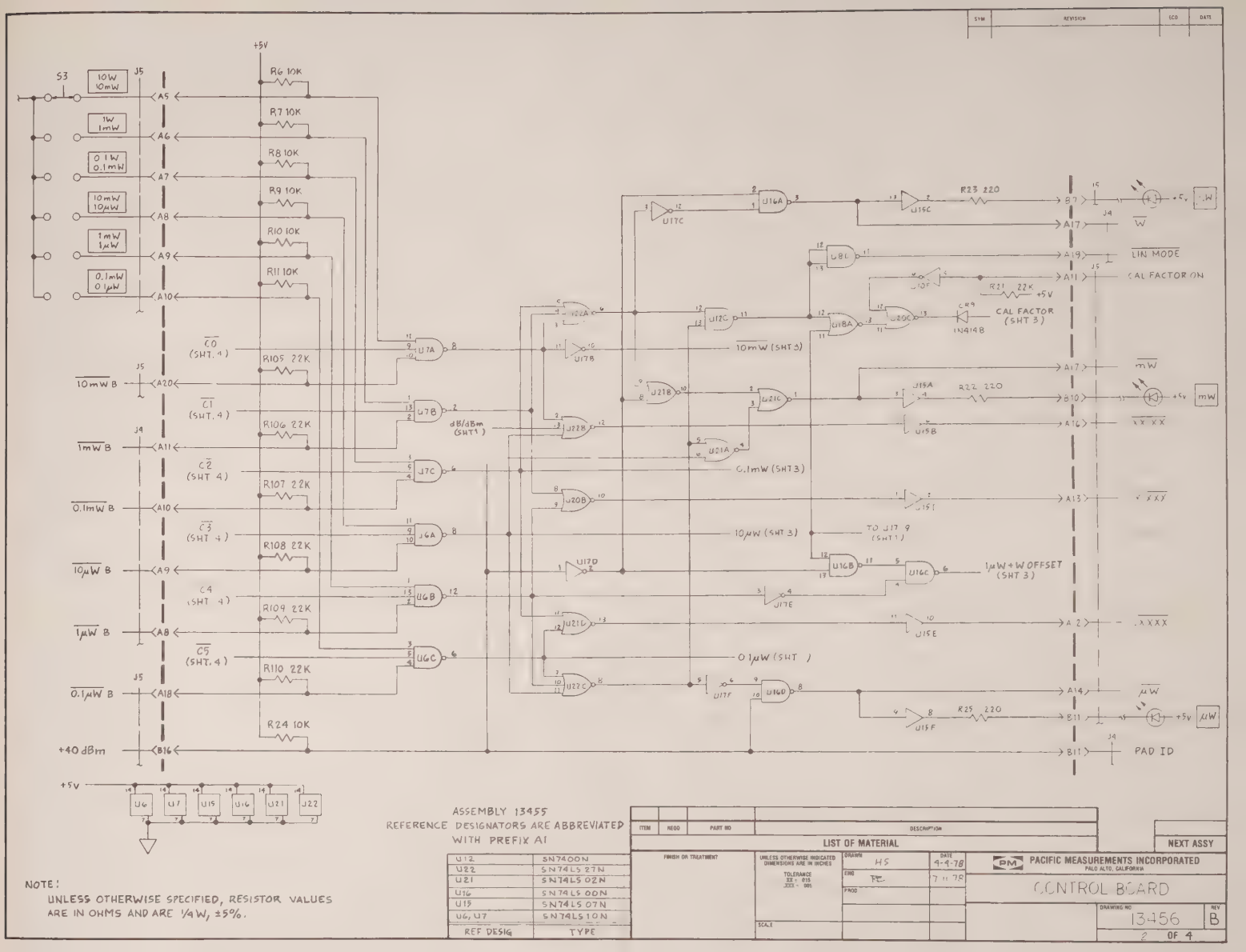
SCALE

DRAWN DAN WATSON 4-22-78
ENG 7-11-78
PROD

PACIFIC MEASUREMENTS INCORPORATED
PALO ALTO CALIFORNIA

CONTROL BOARD

DRAWING NO. 13456 REV B
OF 4



NOTE:
UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE 1/4W, ±5%.

ASSEMBLY 13455
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A1

REF DESIG	TYPE
U12	SN7400N
U22	SN74LS27N
U21	SN74LS02N
U16	SN74LS00N
U15	SN74LS07N
U6, U7	SN74LS10N

SYM	REVISION	ECO	DATE

ITEM	REQD	PART NO	DESCRIPTION

LIST OF MATERIAL

NEXT ASSY

FINISH OR TREATMENT

UNLESS OTHERWISE INDICATED DIMENSIONS ARE IN INCHES
TOLERANCE
XX ± .015
.XXX ± .005

SCALE

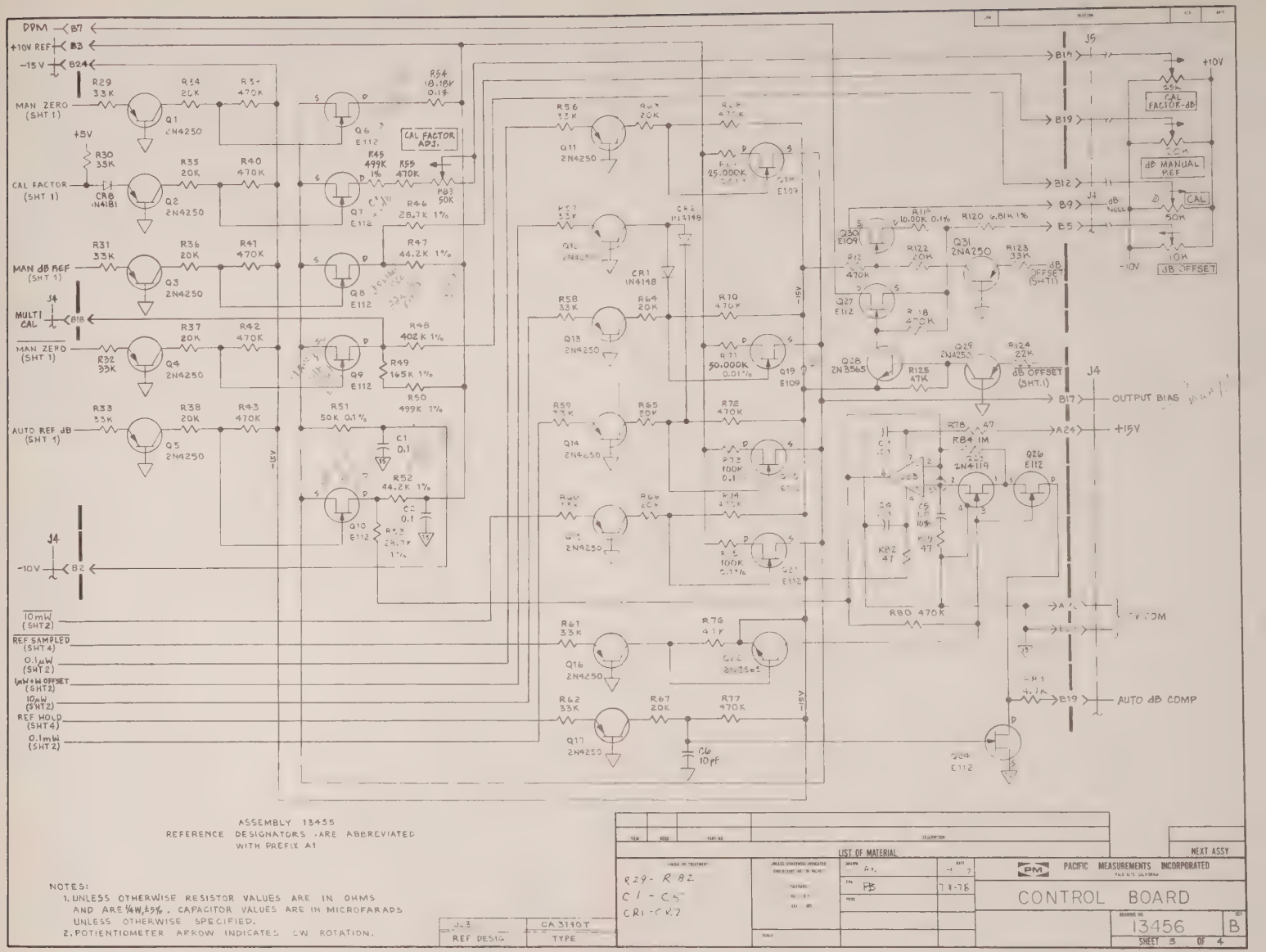
		DATE
DRAWN	HS	4-9-78
ENG		7-11-78
PROD		

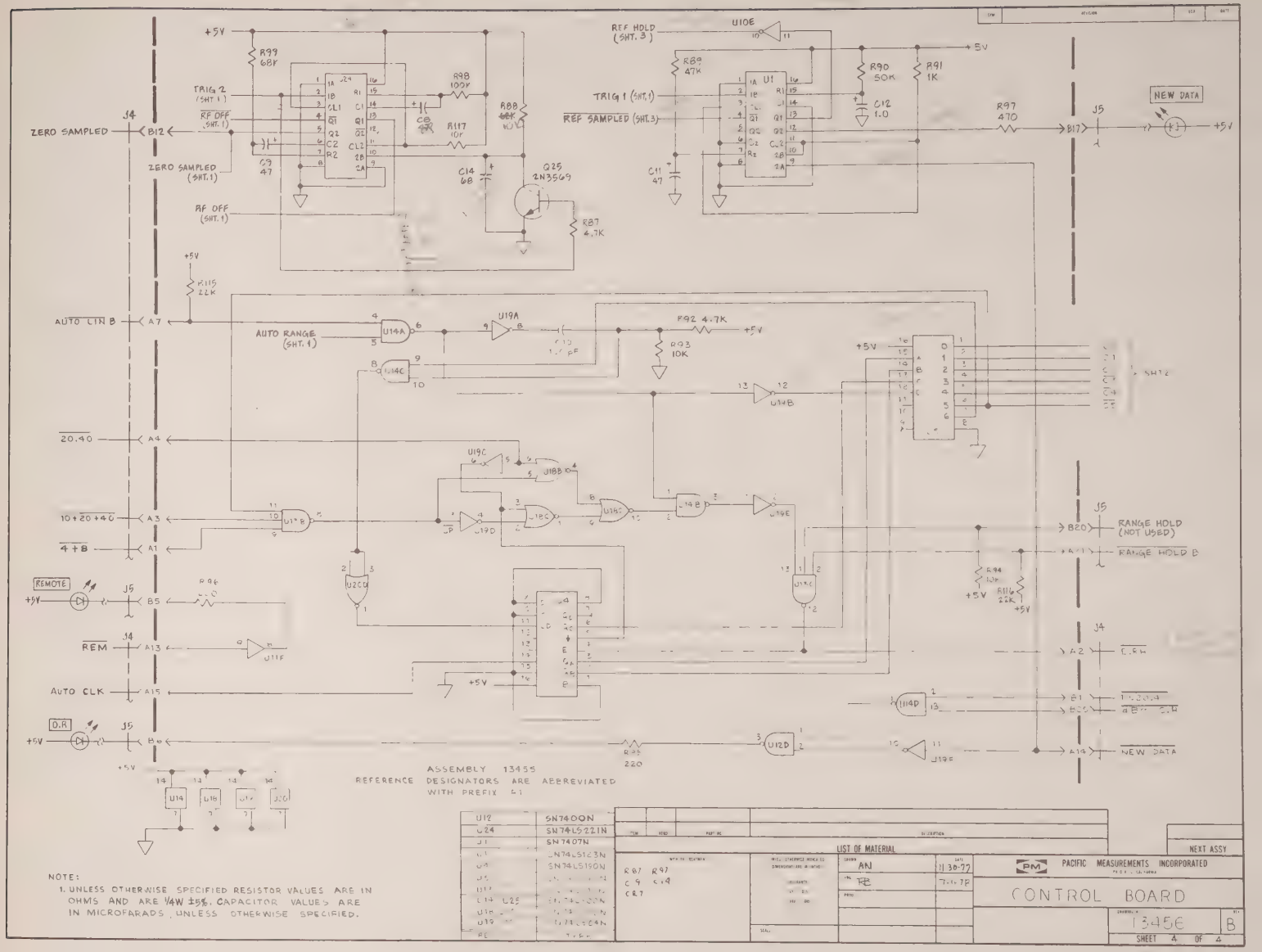
PACIFIC MEASUREMENTS INCORPORATED
PALO ALTO, CALIFORNIA

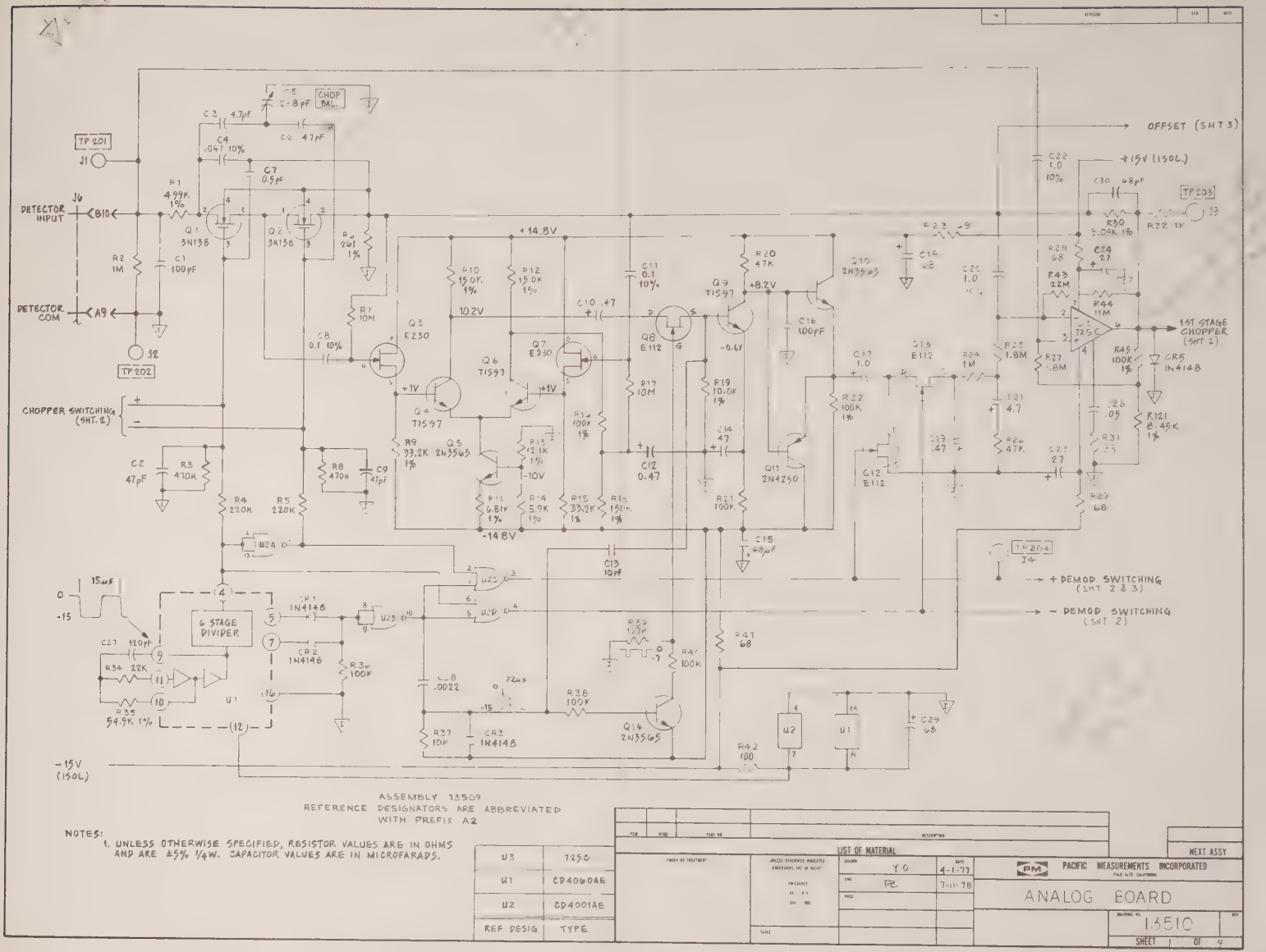
CONTROL BOARD

DRAWING NO 13456 REV B

2 OF 4


DPM
+10V REF
-15V
MAN ZERO (SHT 1)
CAL FACTOR (SHT 1)
MAN dB REF (SHT 1)
MULTI CAL
MAN ZERO (SHT 1)
AUTO REF dB (SHT 1)
-10V
10mW (SHT2)
REF SAMPLED (SHT 4)
0.1μW (SHT 2)
1μW + W OFFSET (SHT2)
10μW (SHT2)
REF HOLD (SHT 4)
0.1mW (SHT 2)
CAL FACTOR ADJ.
+10V
CAL FACTOR-dB
dB MANUAL REF
CAL
dB NULL
dB OFFSET
dB OFFSET (SHT1)
OUTPUT BIAS
+15V
-V COM
AUTO dB COMP
ASSEMBLY 13455
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A1
NOTES:
1. UNLESS OTHERWISE RESISTOR VALUES ARE IN OHMS AND ARE ¼W, ±5%, CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. POTIENTIOMETER ARROW INDICATES CW ROTATION.
LIST OF MATERIAL
NEXT ASSY
R29 - R82
C1 - C5
CR1 - CR2
PACIFIC MEASUREMENTS INCORPORATED
CONTROL BOARD
13456
B
SHEET 3 OF 4
REF DESIG
CA 3110T
TYPE


+5V
R99 68K
TRIG 2 (SHT. 1)
RF OFF (SHT. 1)
R98 100K
R117 10K
R88 68K
C8
C9 47
C14 68
Q25 2N3569
R87 4.7K
ZERO SAMPLED
ZERO SAMPLED (SHT. 1)
J4
B12
REF HOLD (SHT. 3)
U10E
R89 47K
R90 50K
R91 1K
C12 1.0
TRIG 1 (SHT. 1)
REF SAMPLED (SHT. 3)
C11 47
U1
R97 470
J5
B17
NEW DATA
AUTO LIN B
A7
R115 22K
AUTO RANGE (SHT. 1)
U14A
U19A
C10 .1 pF
R92 4.7K
R93 10K
U14C
U14B
20.40
A4
U19C
U19B
U19C
U19D
U19E
10+20+40
A3
4+8
A1
U11B
U19B
U19C
U19E
U19D
J5
B20
RANGE HOLD (NOT USED)
RANGE HOLD B
A21
R94 10K
R116 22K
+5V
REMOTE
J5
B5
R96 220
U20C
U11C
J4
A2
REM
A13
U11F
B1
B20
A19
NEW DATA
AUTO CLK
A15
O.R
J5
B6
R95 220
U12D
U19F
U14
U16
U17
U20
ASSEMBLY 13455
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX 51
NOTE:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS AND ARE 1/4W ±5%. CAPACITOR VALUES ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.
U12 SN7400N
U24 SN74LS221N
U1 SN7407N
U11 SN74LS123N
U20 SN74LS150N
U14, U25 SN74LS00N
U16 SN74LS04N
U19 SN74LS04N
LIST OF MATERIAL
NEXT ASSY
AN
11-30-77
PACIFIC MEASUREMENTS INCORPORATED
CONTROL BOARD
13455
B
SHEET 4 OF 4



ASSEMBLY 13509
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A2

NOTES:
1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±5% 1/4W. CAPACITOR VALUES ARE IN MICROFARADS.

REF DESIG	TYPE
U3	7250
U1	CD4060AE
U2	CD4001AE

LIST OF MATERIAL

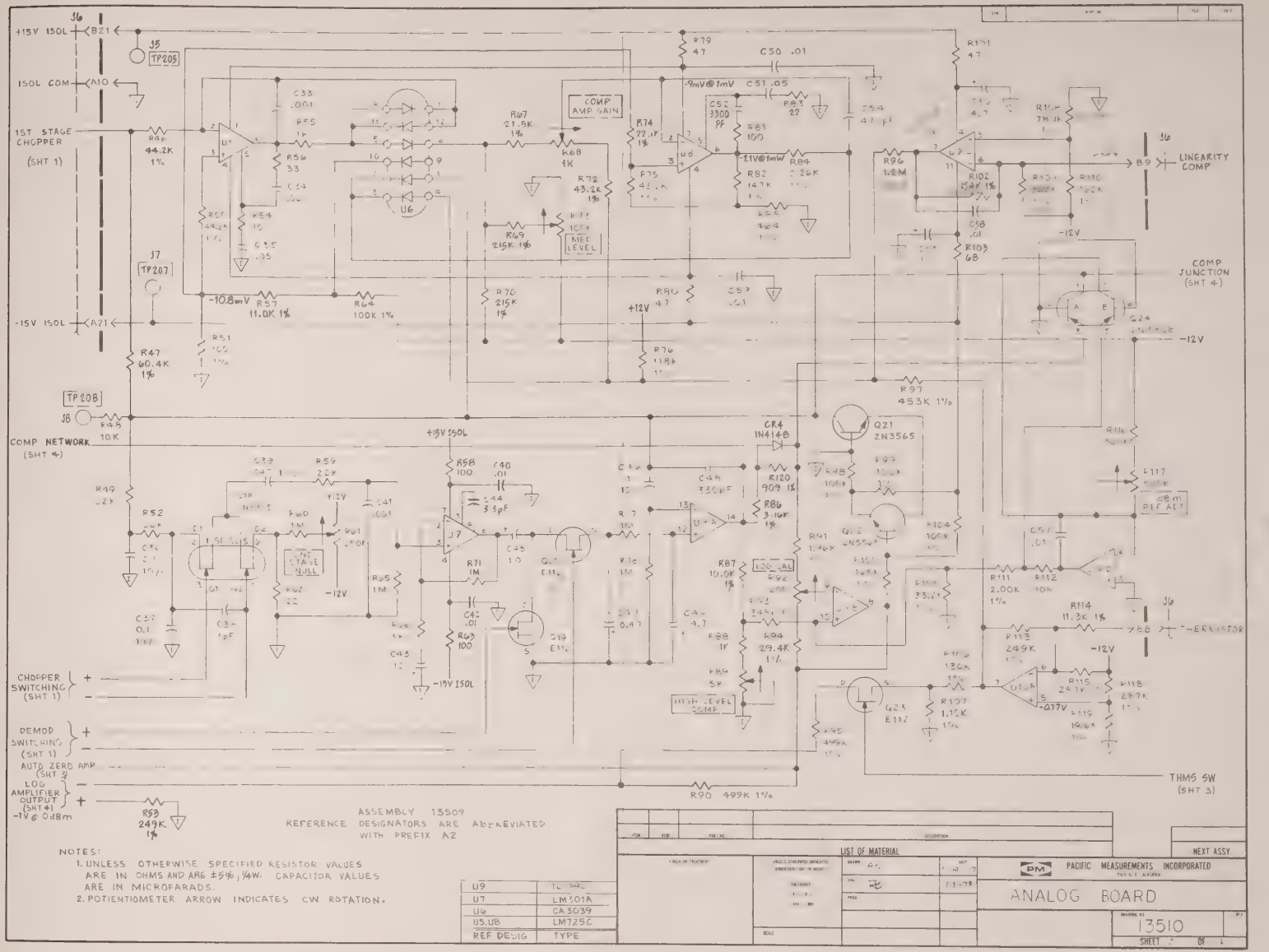
NEXT ASSY

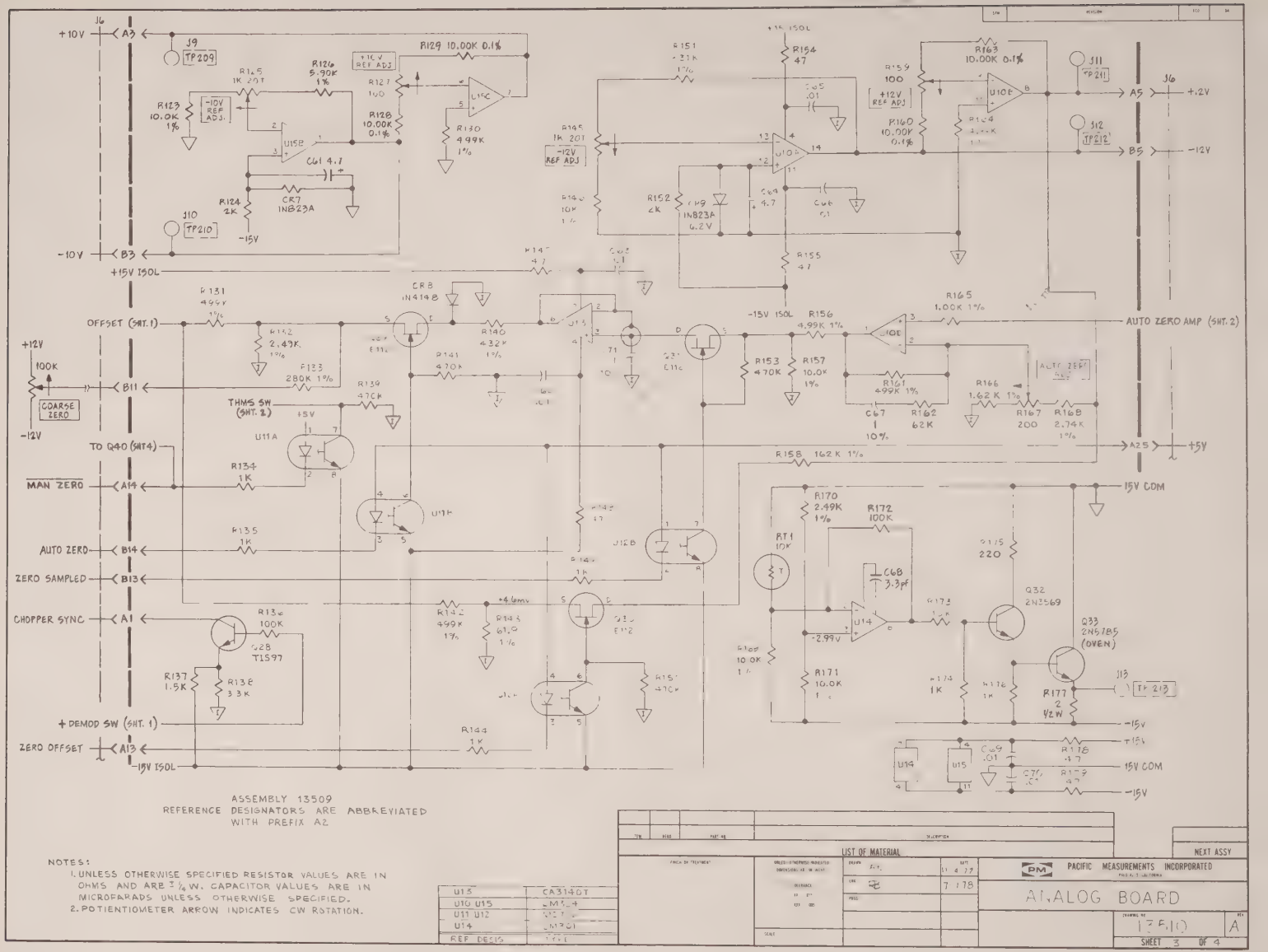
PACIFIC MEASUREMENTS INCORPORATED

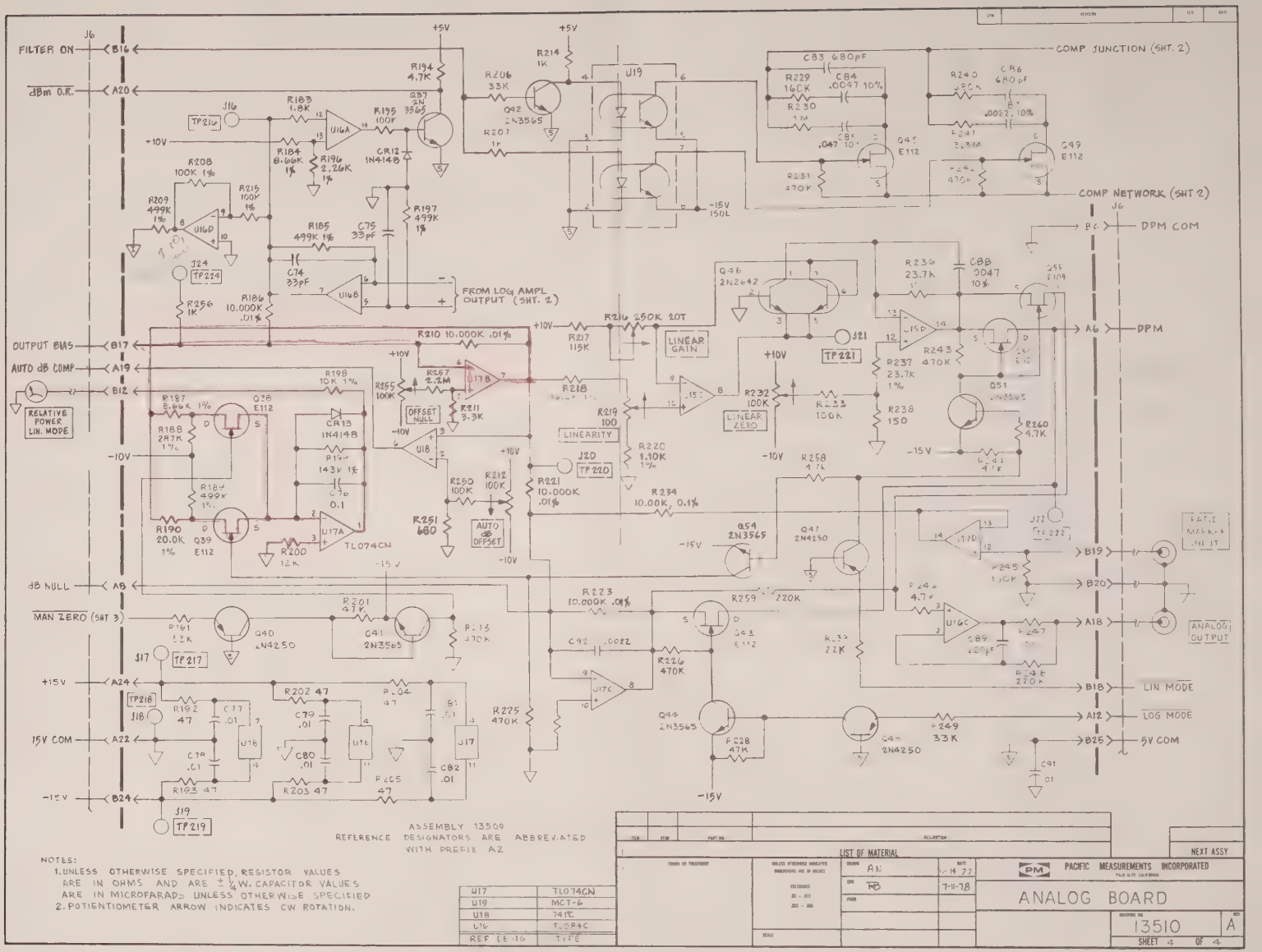
ANALOG BOARD

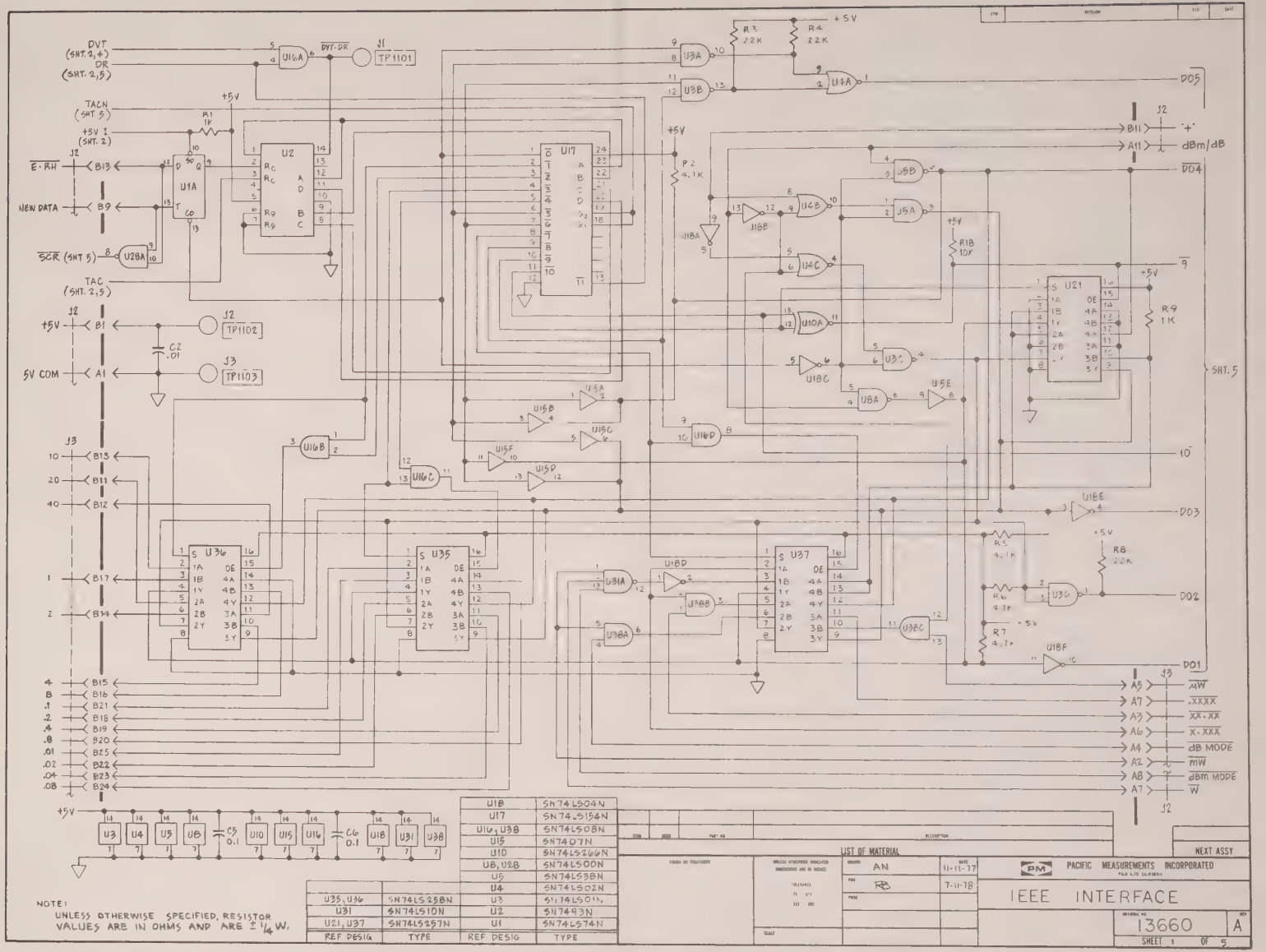
13510

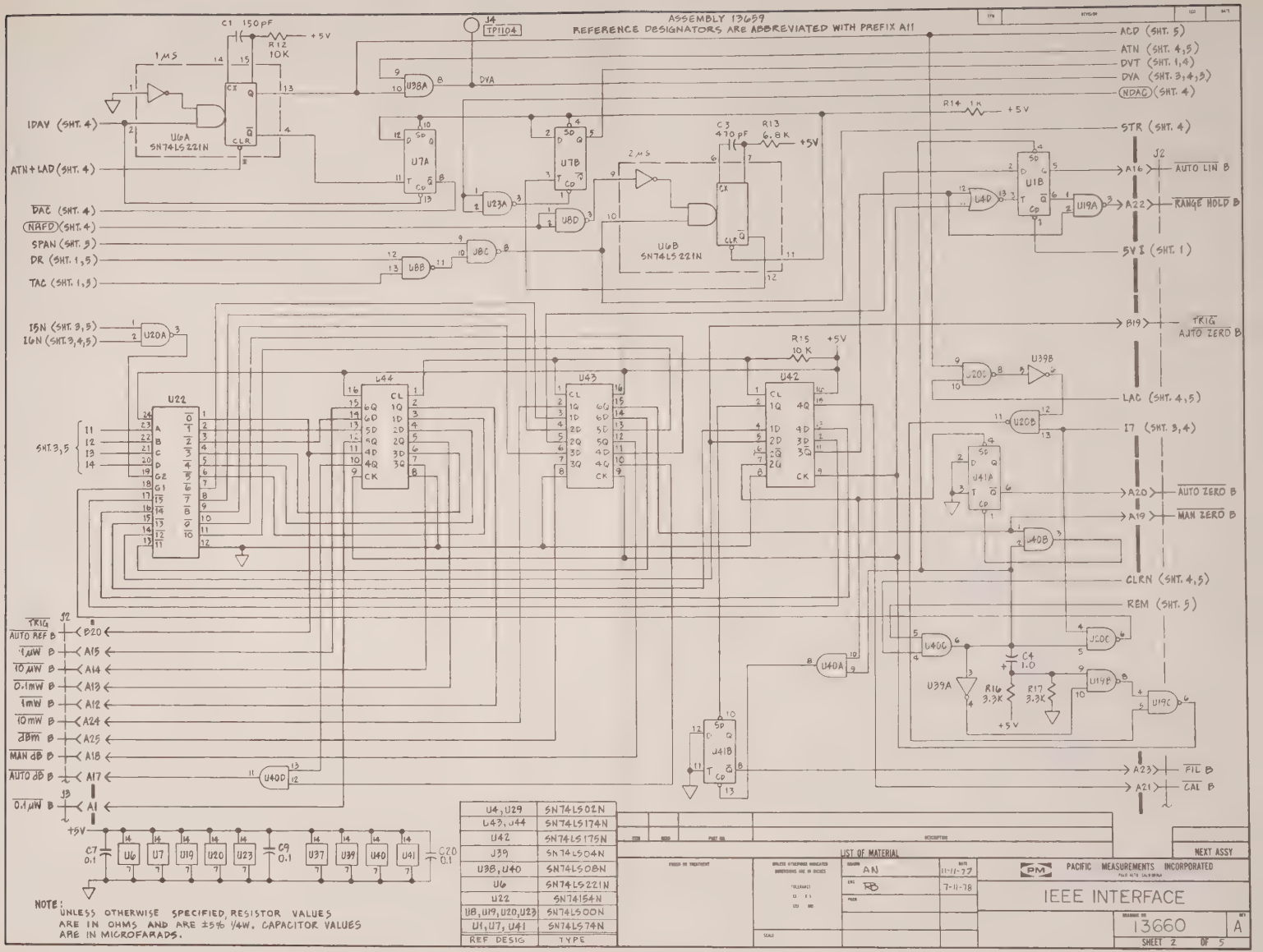
SHEET 1 OF 4

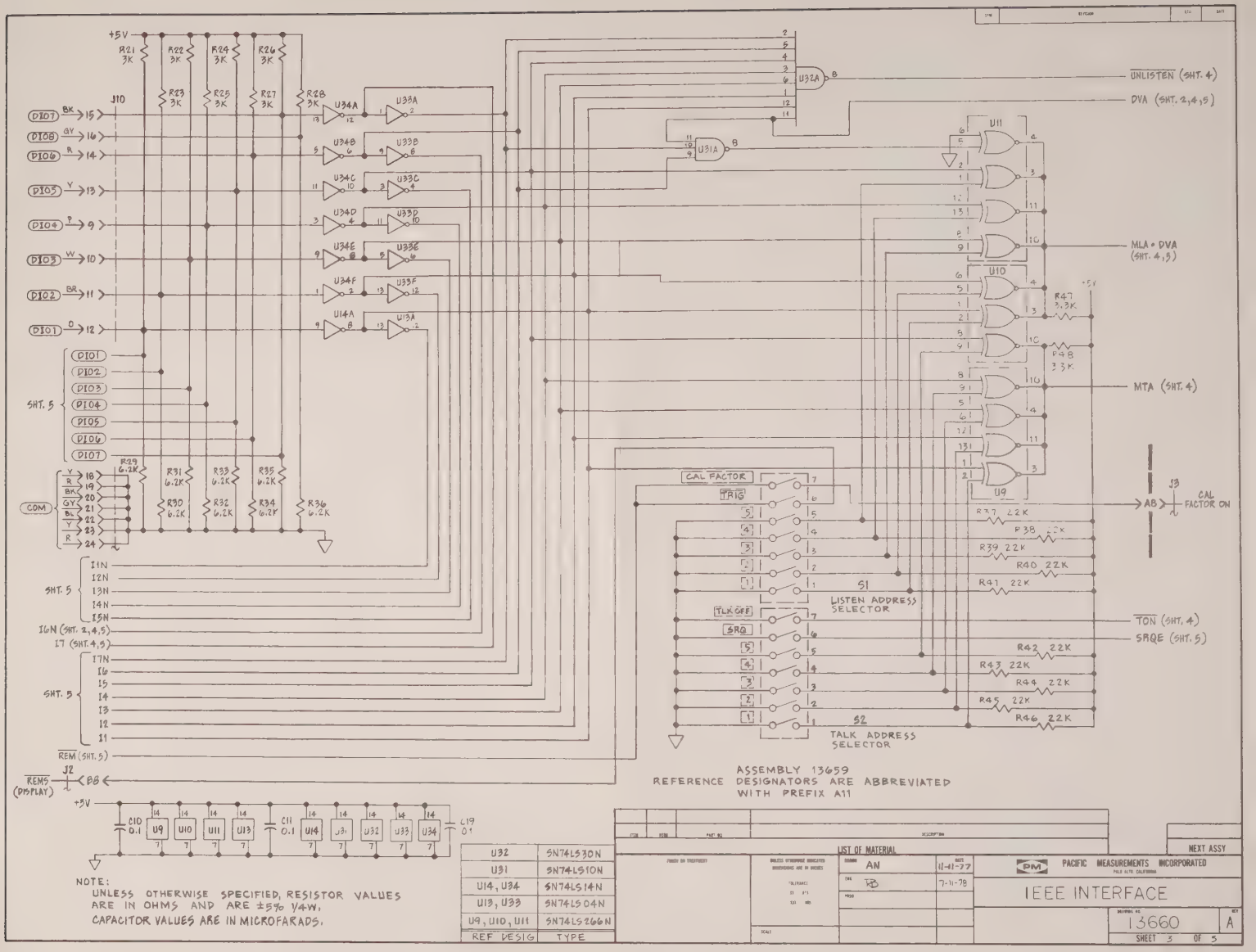

+15V ISOL
ISOL COM
1ST STAGE CHOPPER (SHT 1)
-15V ISOL
COMP NETWORK (SHT 4)
CHOPPER SWITCHING (SHT 1)
DEMOD SWITCHING (SHT 1)
AUTO ZERO AMP (SHT 3)
LOG AMPLIFIER OUTPUT (SHT 4) -1V @ 0dBm
COMP AMP GAIN
LINEARITY COMP
COMP JUNCTION (SHT 4)
THMS SW (SHT 3)
ASSEMBLY 13509
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A2
NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS AND ARE ±5%, ¼W. CAPACITOR VALUES ARE IN MICROFARADS.
2. POTIENTIOMETER ARROW INDICATES CW ROTATION.
U9 TL 082
U7 LM 301A
U6 CA 3039
U5,U8 LM725C
REF DESIG TYPE
LIST OF MATERIAL
NEXT ASSY
PACIFIC MEASUREMENTS INCORPORATED
ANALOG BOARD
13510
SHEET 1 OF 1


+10V
-10V
+15V ISOL
OFFSET (SHT. 1)
+12V
100K
COARSE ZERO
-12V
TO Q40 (SHT 4)
MAN ZERO
AUTO ZERO
ZERO SAMPLED
CHOPPER SYNC
+ DEMOD SW (SHT. 1)
ZERO OFFSET
-15V ISOL
THMS SW (SHT. 2)
AUTO ZERO AMP (SHT. 2)
+12V
-12V
+5V
15V COM
-15V
ASSEMBLY 13509
REFERENCE DESIGNATORS ARE ABBREVIATED
WITH PREFIX A2
NOTES:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS AND ARE 1/4 W. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. POTIENTIOMETER ARROW INDICATES CW ROTATION.
U13 CA3140T
U10 U15 LM324
U11 U12 LM747
U14 LM301
REF DESIG TYPE
LIST OF MATERIAL
NEXT ASSY
PACIFIC MEASUREMENTS INCORPORATED
ANALOG BOARD
13510
A
SHEET 3 OF 4


FILTER ON
dBm O.R.
+10V
OUTPUT BIAS
AUTO dB COMP
RELATIVE POWER LIN. MODE
-10V
dB NULL
MAN ZERO (SHT 3)
+15V
15V COM
-15V
FROM LOG AMPL OUTPUT (SHT. 2)
LINEAR GAIN
LINEARITY
LINEAR ZERO
OFFSET NULL
AUTO dB OFFSET
TL074CN
COMP JUNCTION (SHT. 2)
COMP NETWORK (SHT 2)
DPM COM
DPM
ANALOG OUTPUT
LIN MODE
LOG MODE
5V COM
ASSEMBLY 13509
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A2
NOTES:
1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ± 1/4 W. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED
2. POTIENTIOMETER ARROW INDICATES CW ROTATION.
U17 TL074CN
U19 MCT-6
U18 741C
U16 TL084C
REF DES-16 TYPE
LIST OF MATERIAL
NEXT ASSY
PACIFIC MEASUREMENTS INCORPORATED
ANALOG BOARD
13510
A
SHEET 4 OF 4


DVT (SHT. 2,4)
DR (SHT. 2,5)
TACN (SHT 5)
+5V I (SHT. 2)
E·RH
NEW DATA
SCR (SHT 5)
TAC (SHT. 2,5)
+5V
5V COM
DVT-DR
J1 TP1101
J2 TP1102
J3 TP1103
R1 1K
R2 4.1K
R3 22K
R4 22K
R5 4.1K
R6 4.7K
R7 4.7K
R8 22K
R9 1K
R10 10K
C2 .01
C5 0.1
C6 0.1
U1A
U2
U3A
U3B
U4A
U4B
U4C
U5A
U5B
U5C
U5E
U8A
U10A
U10B
U10C
U15A
U15B
U15C
U15D
U15E
U15F
U16A
U16B
U16C
U16D
U17
U18A
U18B
U18C
U18D
U18E
U18F
U21
U35
U36
U37
U38A
U38B
U38C
DO5
DO4
DO3
DO2
DO1
SHT. 5
dBm/dB
dB MODE
dBm MODE
B11
A11
B13
B9
B1
A1
B10
B20
B40
B1
B2
B4
B8
B16
B21
B18
B19
B20
B25
B22
B23
B24
A5
A7
A3
A6
A4
A2
A8
A7
NOTE:
UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ± 1/4 W.
REF DESIG
TYPE
U35, U36
SN74LS258N
U31
SN74LS10N
U21, U37
SN74LS257N
U18
SN74LS04N
U17
SN74LS154N
U10, U38
SN74LS08N
U15
SN7407N
U10
SN74LS266N
U8, U28
SN74LS00N
U5
SN74LS38N
U4
SN74LS02N
U3
SN74LS01N
U2
SN7493N
U1
SN74LS74N
LIST OF MATERIAL
NEXT ASSY
AN
11-11-77
RB
7-11-78
PACIFIC MEASUREMENTS INCORPORATED
IEEE INTERFACE
13660
A
SHEET 1 OF 5


ASSEMBLY 13659
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A11
ACD (SHT. 5)
ATN (SHT. 4,5)
DVT (SHT. 1,4)
DVA (SHT. 3,4,5)
NDAC (SHT. 4)
STR (SHT. 4)
AUTO LIN B
RANGE HOLD B
5V I (SHT. 1)
TRIG AUTO ZERO B
LAC (SHT. 4,5)
I7 (SHT. 3,4)
AUTO ZERO B
MAN ZERO B
CLRN (SHT. 4,5)
REM (SHT. 5)
FIL B
CAL B
IDAV (SHT. 4)
ATN+LAD (SHT. 4)
DAC (SHT. 4)
NAFD (SHT. 4)
SPAN (SHT. 3)
DR (SHT. 1,3)
TAC (SHT. 1,3)
ISN (SHT. 3,5)
IGN (SHT. 3,4,5)
SHT. 3,5
AUTO REF B
1μW B
10μW B
0.1mW B
1mW B
10mW B
dBm B
MAN dB B
AUTO dB B
0.1μW B
+5V
C1 150pF
R12 10K
R13 6.8K
R14 1K
R15 10K
C3 470pF
C4 1.0
R16 3.3K
R17 3.3K
C7 0.1
C9 0.1
C20 0.1
1MS
2MS
U6A SN74LS221N
U6B SN74LS221N
TP1104
NOTE:
UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±5% 1/4W. CAPACITOR VALUES ARE IN MICROFARADS.
U4,U29 SN74LS02N
U43,U44 SN74LS174N
U42 SN74LS175N
U39 SN74LS04N
U38,U40 SN74LS08N
U6 SN74LS221N
U22 SN74154N
U8,U19,U20,U23 SN74LS00N
U1,U7,U41 SN74LS74N
REF DESIG TYPE
LIST OF MATERIAL
NEXT ASSY
PACIFIC MEASUREMENTS INCORPORATED
IEEE INTERFACE
13660
A
SHEET 2 OF 5
AN 11-11-77
RD 7-11-78



ASSEMBLY 13659
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A11

NOTE:
UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±5% ¼W.
CAPACITOR VALUES ARE IN MICROFARADS.

REF DESIG	TYPE
U32	SN74LS30N
U31	SN74LS10N
U14, U34	SN74LS14N
U13, U33	SN74LS04N
U9, U10, U11	SN74LS266N

LIST OF MATERIAL

NEXT ASSY

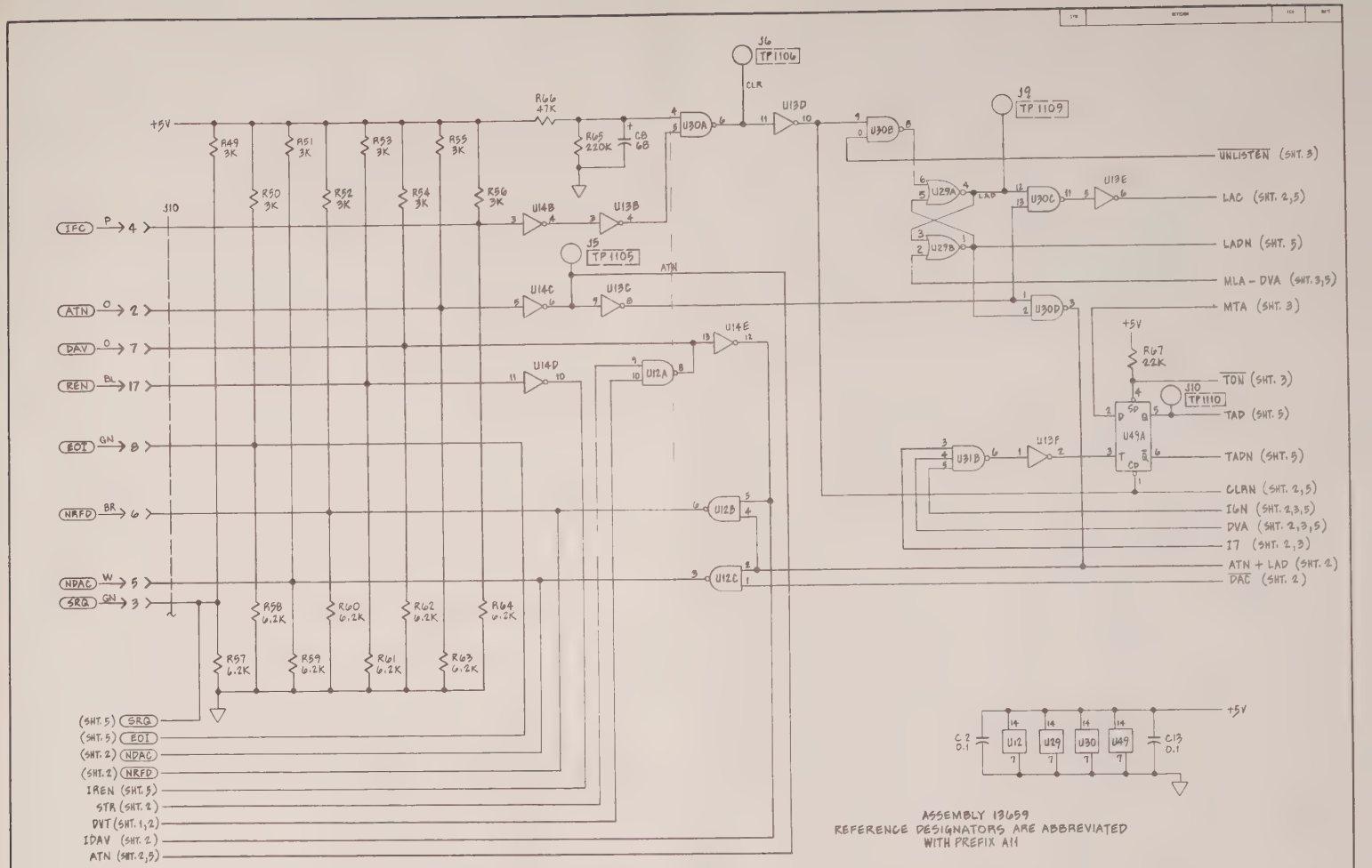
DRAWN	AN
DATE	11-11-77
CHK	TB
DATE	7-11-78

PACIFIC MEASUREMENTS INCORPORATED

IEEE INTERFACE

DRAWING NO. 13660 REV A

SHEET 3 OF 3



ASSEMBLY 13659
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A11

NOTE:
1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ARE ±5% 1/4W. CAPACITOR VALUES ARE IN MICROFARADS.

REF DESIG	TYPE
U49	SN74LS74N
U31	SN74LS10N
U30	SN74LS00N
U29	SN74LS02N
U14	SN74LS14N
U13	SN74LS04N
U12	SN74LS38N

LIST OF MATERIAL

NEXT ASSY

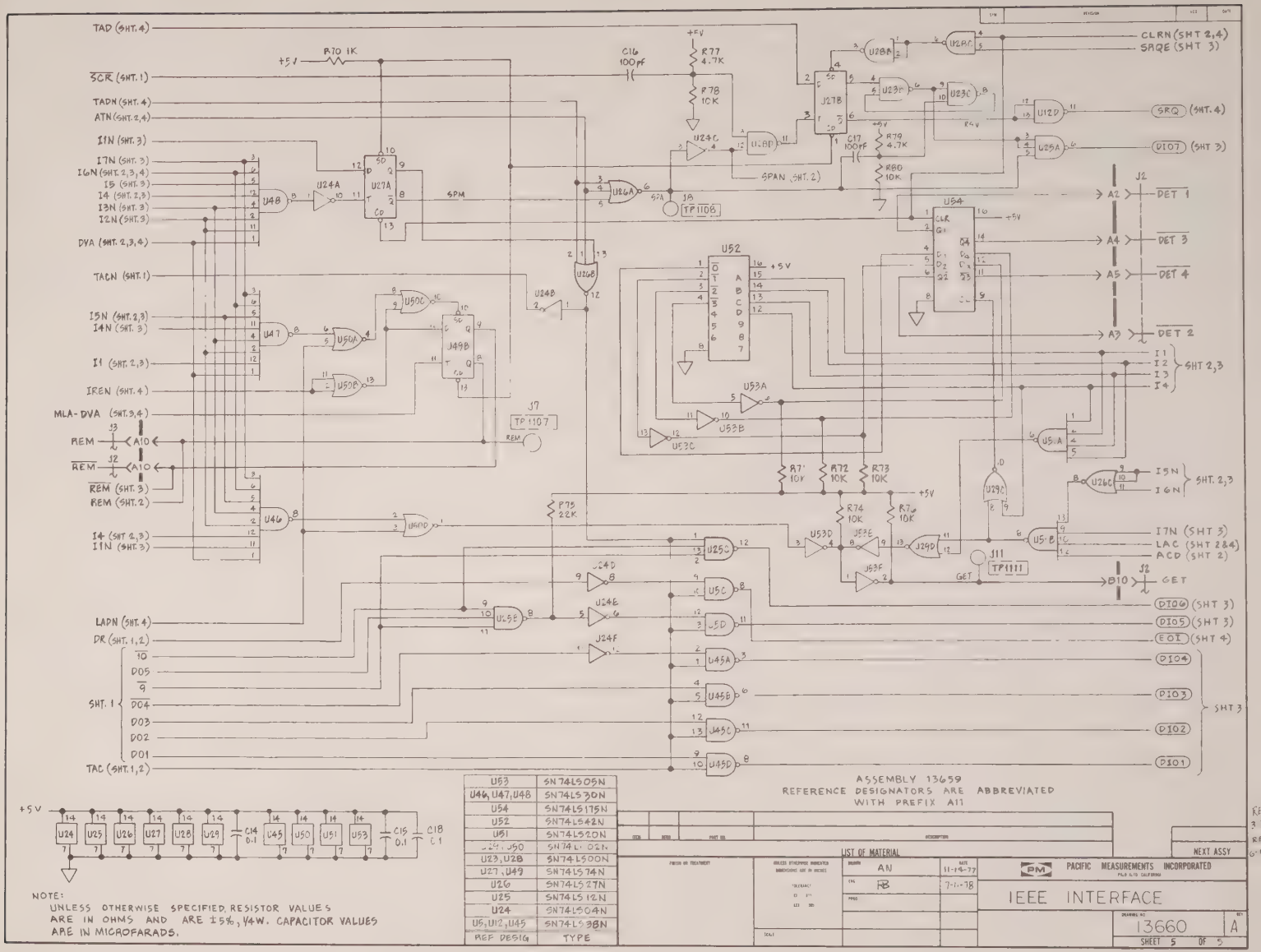
DRAWN	AN	11-11-77
CHK	RB	7-1-78
PROD		

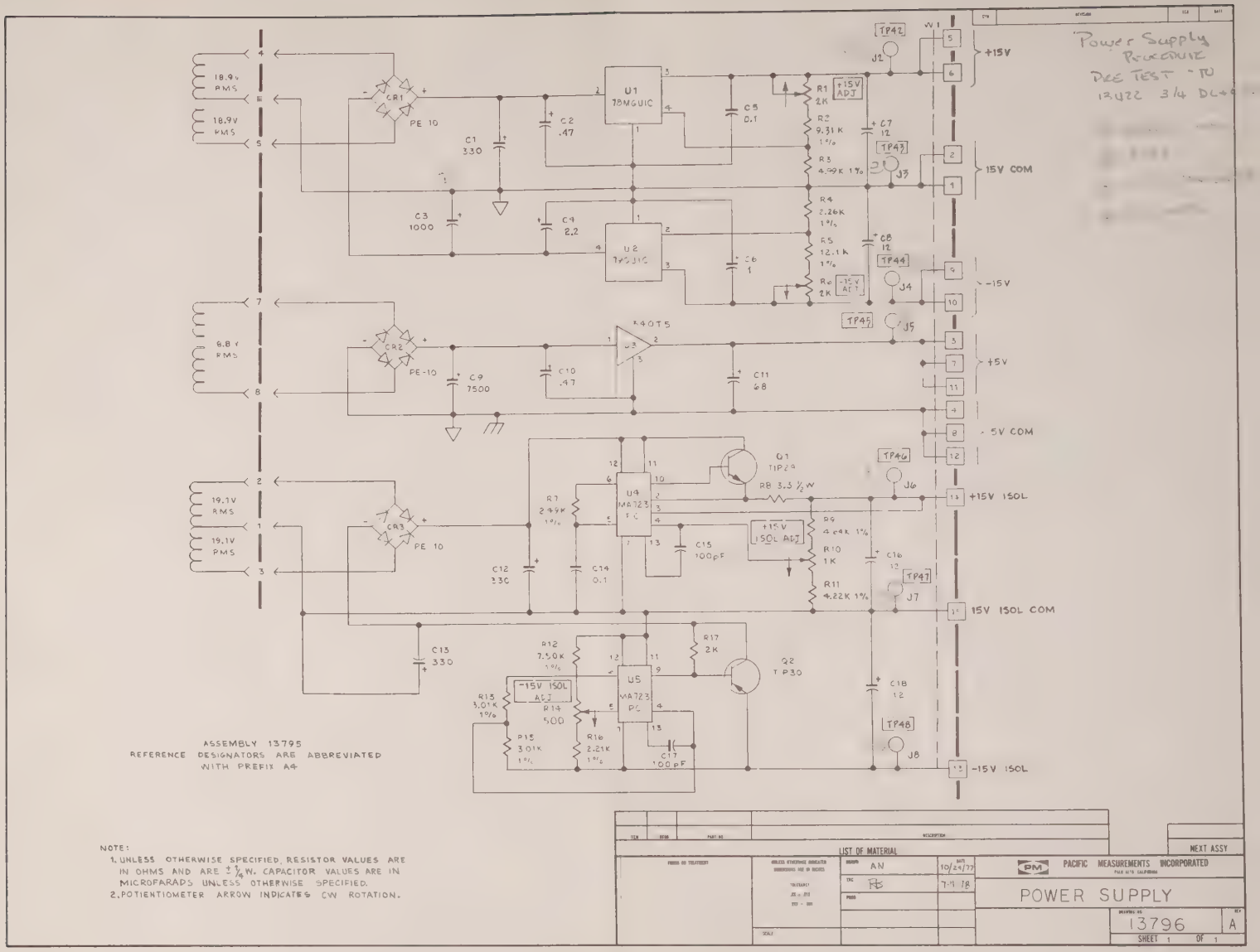
PACIFIC MEASUREMENTS INCORPORATED
PALO ALTO, CALIFORNIA

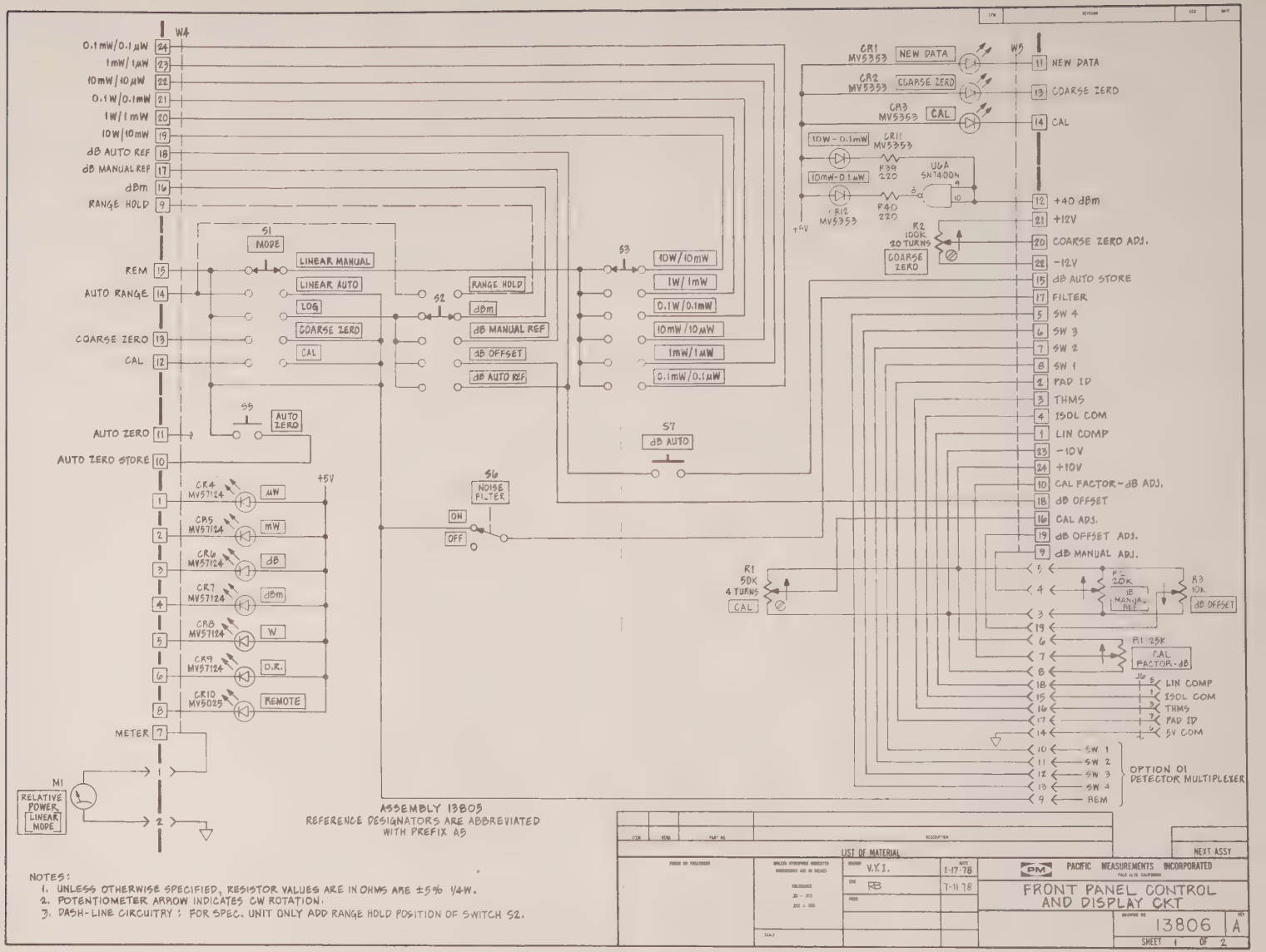
IEEE INTERFACE

DRAWING NO. 13660 REV A

SHEET 4 OF 5


TAD (SHT. 4)
SCR (SHT. 1)
TADN (SHT. 4)
ATN (SHT. 2,4)
I1N (SHT. 3)
I7N (SHT. 3)
I6N (SHT. 2,3,4)
I5 (SHT. 3)
I4 (SHT. 2,3)
I3N (SHT. 3)
I2N (SHT. 3)
DVA (SHT. 2,3,4)
TACN (SHT. 1)
I5N (SHT. 2,3)
I4N (SHT. 3)
I1 (SHT. 2,3)
IREN (SHT. 4)
MLA-DVA (SHT. 3,4)
REM
REM
REM (SHT. 3)
REM (SHT. 2)
I4 (SHT 2,3)
I1N (SHT. 3)
LADN (SHT. 4)
DR (SHT. 1,2)
SHT. 1
TAC (SHT. 1,2)
+5V
R70 1K
C16 100pf
R77 4.7K
R78 10K
C17 100pf
R79 4.7K
R80 10K
R75 22K
R71 10K
R72 10K
R73 10K
R74 10K
R76 10K
SPM
SPAN (SHT. 2)
SPA
TP1106
TP1107
TP1111
GET
CLRN (SHT 2,4)
SRQE (SHT 3)
SRQ (SHT. 4)
DIO7 (SHT 3)
DET 1
DET 3
DET 4
DET 2
I1
I2
I3
I4
SHT 2,3
I5N
I6N
SHT. 2,3
I7N (SHT 3)
LAC (SHT 2&4)
ACD (SHT 2)
DIO6 (SHT 3)
DIO5 (SHT 3)
EOI (SHT 4)
DIO4
DIO3
DIO2
DIO1
SHT 3
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
J11
J12
U24
U25
U26
U27
U28
U29
U45
U50
U51
U53
C14 0.1
C15 0.1
C18 0.1
NOTE:
UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±5%, 1/4W. CAPACITOR VALUES ARE IN MICROFARADS.
U53 SN74LS05N
U46, U47, U48 SN74LS30N
U54 SN74LS175N
U52 SN74LS42N
U51 SN74LS20N
U24, U50 SN74L.02N
U23, U28 SN74LS00N
U27, U49 SN74LS74N
U26 SN74LS27N
U25 SN74LS12N
U24 SN74LS04N
U5, U12, U45 SN74LS38N
REF DESIG TYPE
ASSEMBLY 13659
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A11
LIST OF MATERIAL
NEXT ASSY
AN 11-14-77
RB 7-1-78
PACIFIC MEASUREMENTS INCORPORATED
IEEE INTERFACE
13660 A
SHEET 5 OF 5


Power Supply Procedure
DEE TEST "TU
12.422 3/4 DC+9
18.9V RMS
18.9V RMS
CR1
PE 10
C1 330
C2 .47
C3 1000
C4 2.2
U1 78M6UIC
U2 79S15C
C5 0.1
C6 1
R1 2K
+15V ADJ
R2 9.31K 1%
R3 4.99K 1%
R4 2.26K 1%
R5 12.1K 1%
R6 2K
-15V ADJ
C7 12
C8 12
TP42
TP43
TP44
TP45
J2
J3
J4
J5
+15V
15V COM
-15V
+5V
6.8V RMS
CR2
PE-10
C9 7500
C10 .47
C11 68
U3 7805
5V COM
19.1V RMS
19.1V RMS
CR3
PE 10
C12 330
C13 330
C14 0.1
C15 100pF
U4 MA723 TC
U5 MA723 DC
Q1 TIP29
Q2 TP30
RB 3.3 1/2W
R7 2.49K 1%
R8 4.64K 1%
R9 4.64K 1%
R10 1K
R11 4.22K 1%
R12 7.50K 1%
R13 3.01K 1%
R14 500
R15 3.01K 1%
R16 2.21K 1%
R17 2K
+15V ISOL ADJ
-15V ISOL ADJ
C16 12
C17 100pF
C18 12
TP46
TP47
TP48
J6
J7
J8
+15V ISOL
15V ISOL COM
-15V ISOL
ASSEMBLY 13795
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A4
NOTE:
1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ± 1/8 W. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.
2. POTIENTIOMETER ARROW INDICATES CW ROTATION.
LIST OF MATERIAL
NEXT ASSY
AN
10/24/77
7-4-78
PACIFIC MEASUREMENTS INCORPORATED
POWER SUPPLY
13796
A
SHEET 1 OF 1



ASSEMBLY 13805
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A5

NOTES:
1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS ARE ±5% 1/4W.
2. POTENTIOMETER ARROW INDICATES CW ROTATION.
3. DASH-LINE CIRCUITRY : FOR SPEC. UNIT ONLY ADD RANGE HOLD POSITION OF SWITCH S2.

LIST OF MATERIAL

NEXT ASSY

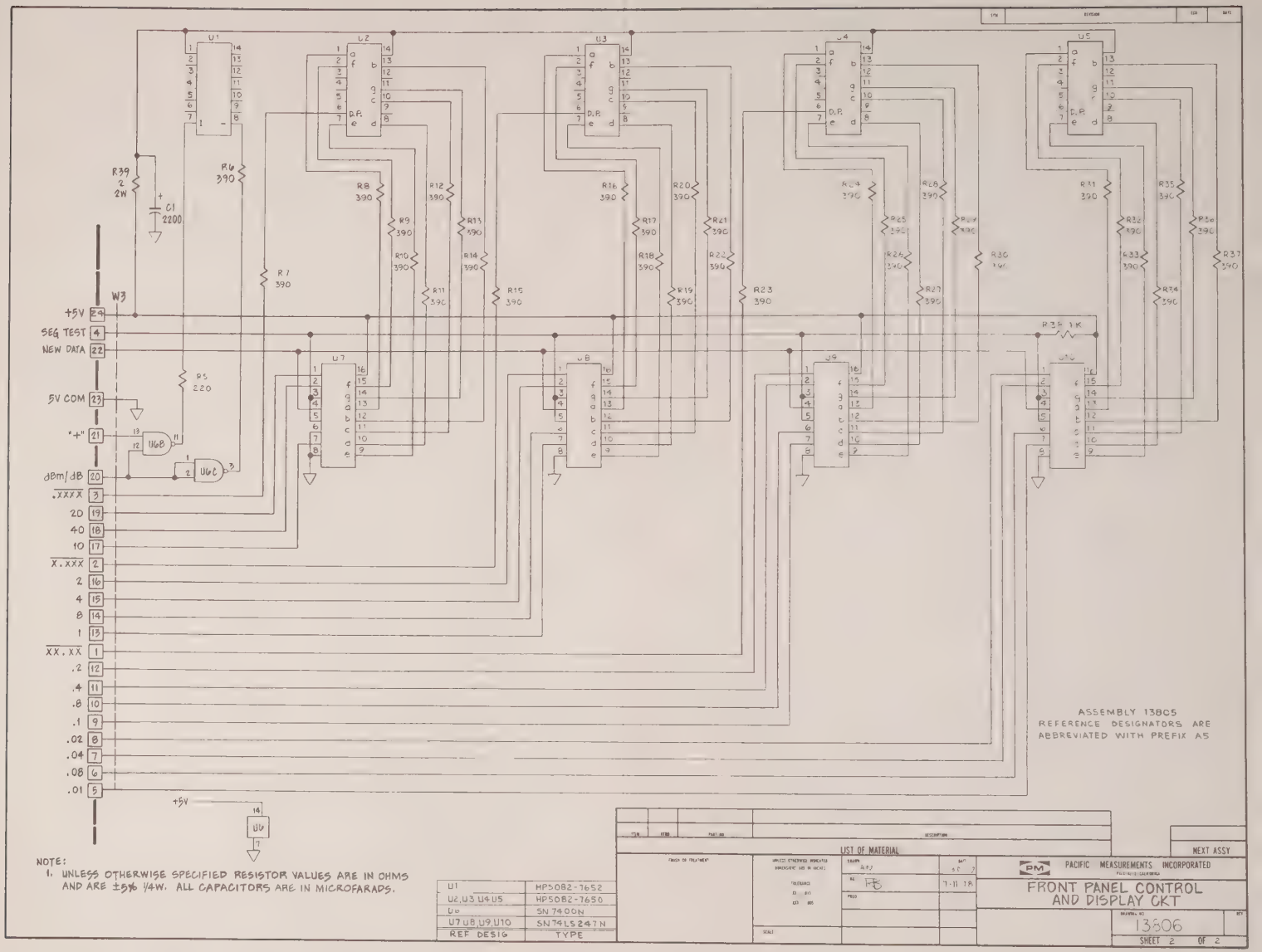
DRAWN V.Y.I. 1-17-78
ENG RB 7-11 78

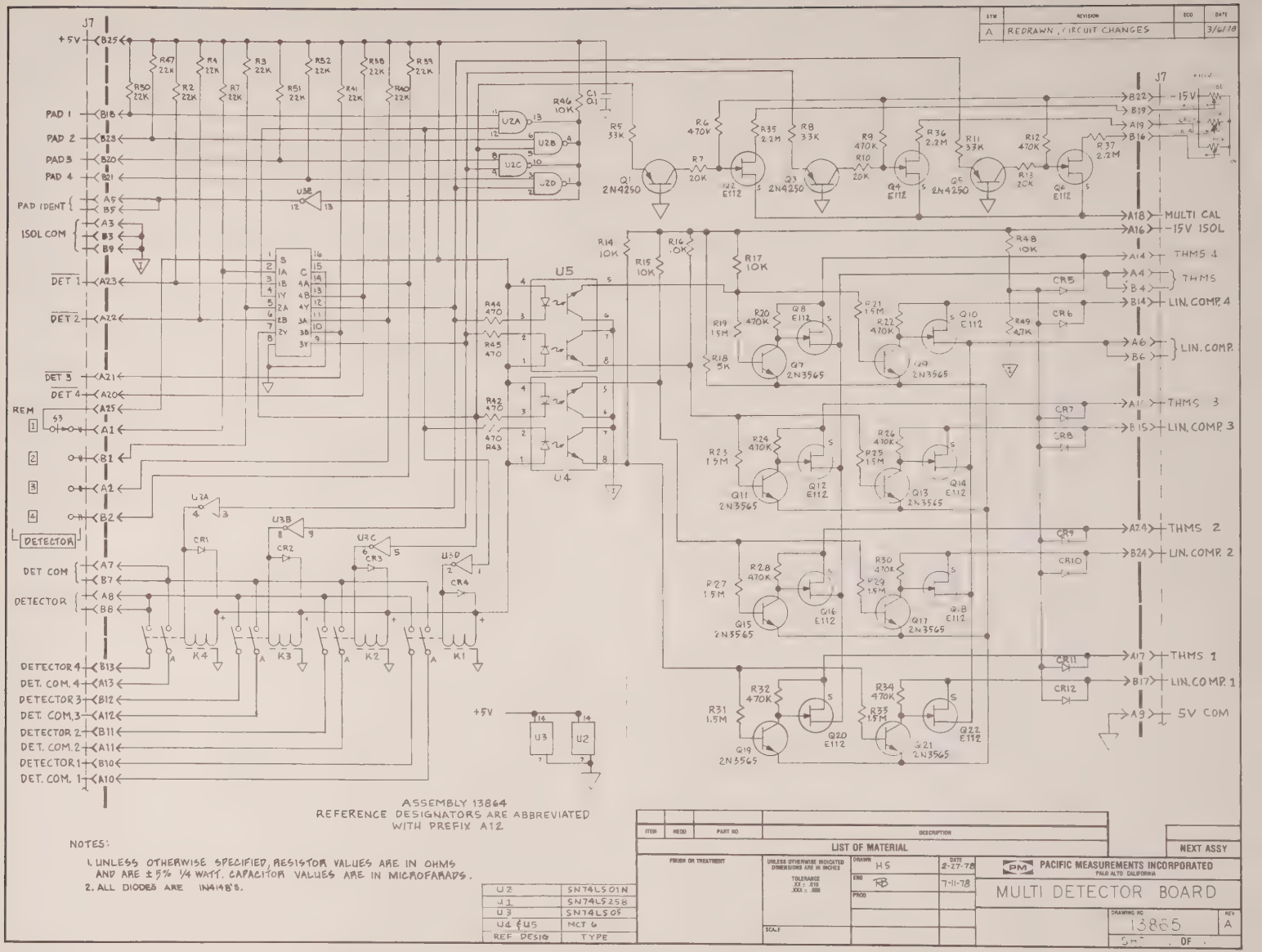
PACIFIC MEASUREMENTS INCORPORATED

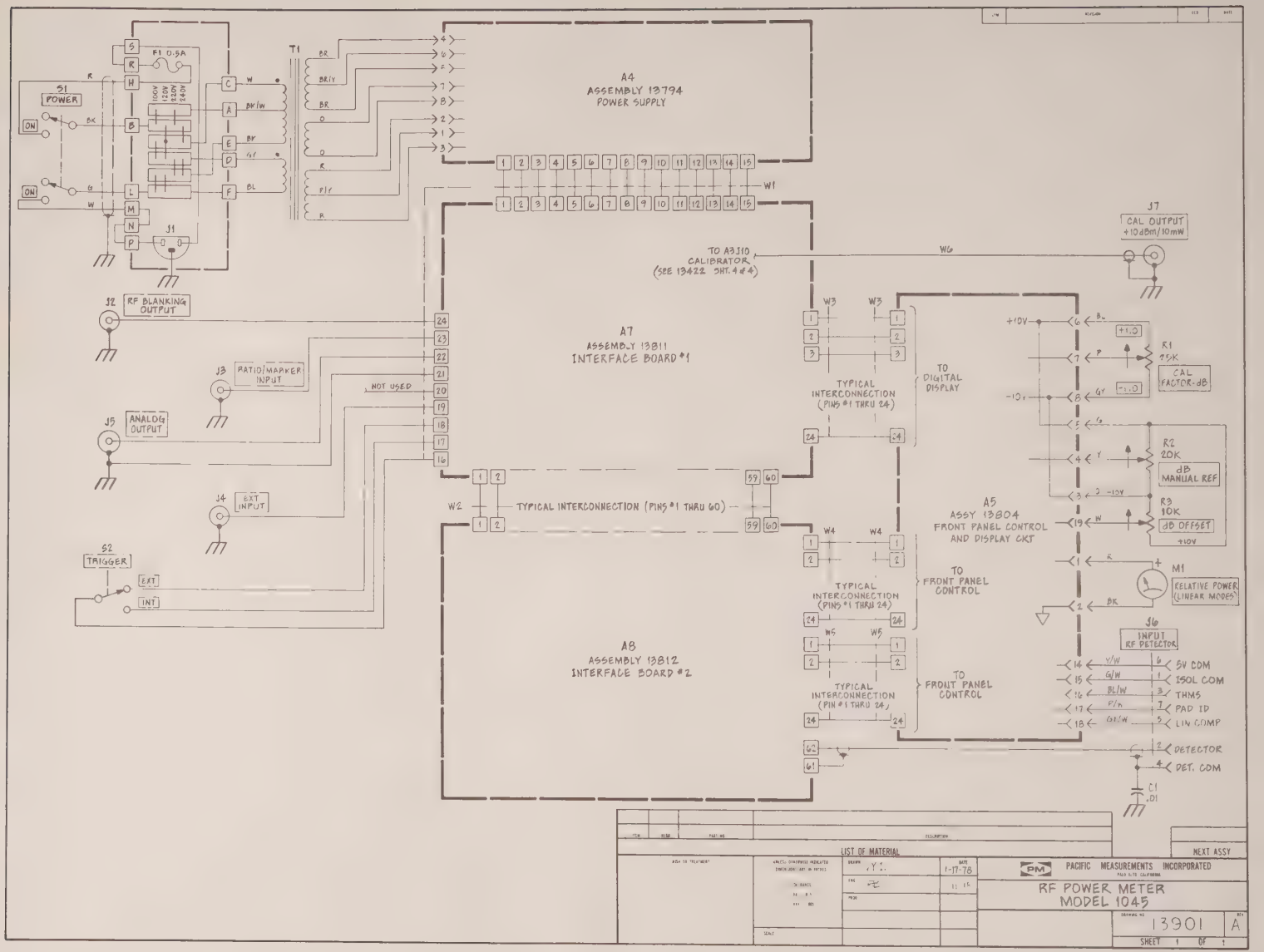
FRONT PANEL CONTROL AND DISPLAY CKT

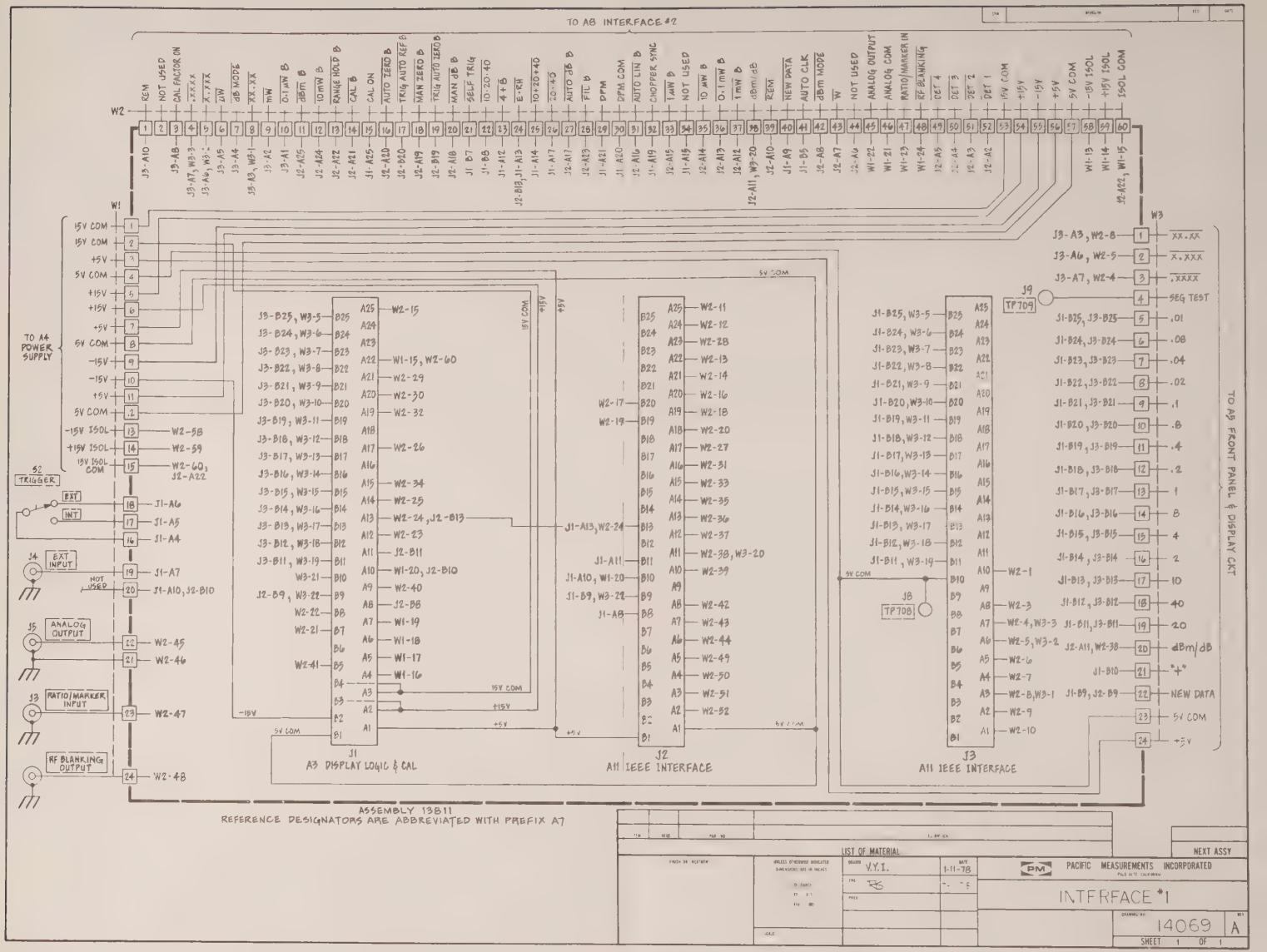
13806 A

SHEET 1 OF 2


U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
R39 2 2W
C1 2200
R6 390
R1 390
R8 390
R9 390
R10 390
R11 390
R12 390
R13 390
R14 390
R15 390
R16 390
R17 390
R18 390
R19 390
R20 390
R21 390
R22 390
R23 390
R24 390
R25 390
R26 390
R27 390
R28 390
R30 390
R31 390
R32 390
R33 390
R34 390
R35 390
R36 390
R37 390
R38 1K
R5 220
W3
+5V 24
SEG TEST 4
NEW DATA 22
5V COM 23
"+" 21
dBm/dB 20
.XXXX 3
20 19
40 18
10 17
X.XXX 2
2 16
4 15
8 14
1 13
XX.XX 1
.2 12
.4 11
.8 10
.1 9
.02 8
.04 7
.08 6
.01 5
+5V
U6B
U6C
U10
ASSEMBLY 13805
REFERENCE DESIGNATORS ARE
ABBREVIATED WITH PREFIX AS
NOTE:
1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS AND ARE ±5% 1/4W. ALL CAPACITORS ARE IN MICROFARADS.
U1 HP5082-7652
U2,U3,U4,U5 HP5082-7650
U6 SN7400N
U7,U8,U9,U10 SN74LS247N
REF DESIG TYPE
LIST OF MATERIAL
NEXT ASSY
PACIFIC MEASUREMENTS INCORPORATED
FRONT PANEL CONTROL AND DISPLAY CKT
13806
SHEET 2 OF 2

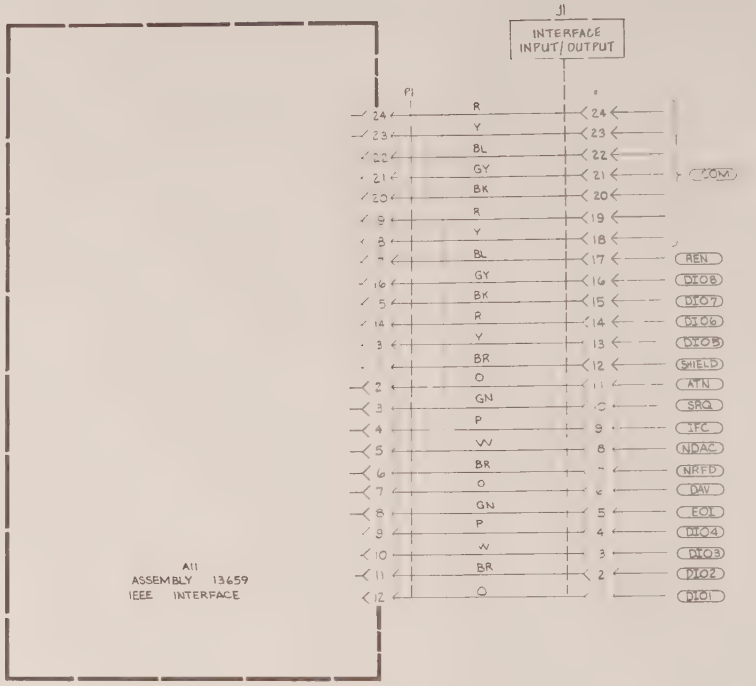

REVISION
A REDRAWN, CIRCUIT CHANGES 3/6/78
J7
+5V
PAD 1
PAD 2
PAD 3
PAD 4
PAD IDENT
ISOL COM
DET 1
DET 2
DET 3
DET 4
REM
DETECTOR
DET COM
DETECTOR
DETECTOR 4
DET. COM. 4
DETECTOR 3
DET. COM. 3
DETECTOR 2
DET. COM. 2
DETECTOR 1
DET. COM. 1
-15V
MULTI CAL
-15V ISOL
THMS 4
THMS
LIN. COMP. 4
LIN. COMP.
THMS 3
LIN. COMP. 3
THMS 2
LIN. COMP. 2
THMS 1
LIN. COMP. 1
5V COM
U5
U4
ASSEMBLY 13864
REFERENCE DESIGNATORS ARE ABBREVIATED
WITH PREFIX A12.
NOTES:
1. UNLESS OTHERWISE SPECIFIED, RESISTOR VALUES ARE IN OHMS AND ARE ±5% 1/4 WATT. CAPACITOR VALUES ARE IN MICROFARADS.
2. ALL DIODES ARE IN4148'S.
U2 SN74LS01N
U1 SN74LS258
U3 SN74LS05
U4 & U5 MCT 6
REF DESIG TYPE
LIST OF MATERIAL
NEXT ASSY
PACIFIC MEASUREMENTS INCORPORATED
PALO ALTO CALIFORNIA
MULTI DETECTOR BOARD
DRAWING NO 13865
REV A
DRAWN HS 2-27-78
ENG TB 7-11-78


A4
ASSEMBLY 13794
POWER SUPPLY
S1
POWER
F1 0.5A
T1
J1
A7
ASSEMBLY 13811
INTERFACE BOARD #1
A8
ASSEMBLY 13812
INTERFACE BOARD #2
A5
ASSY 13804
FRONT PANEL CONTROL
AND DISPLAY CKT
J2 RF BLANKING OUTPUT
J3 RATIO/MARKER INPUT
J5 ANALOG OUTPUT
J4 EXT INPUT
S2 TRIGGER
EXT
INT
NOT USED
TYPICAL INTERCONNECTION (PINS #1 THRU 60)
TYPICAL INTERCONNECTION (PINS #1 THRU 24)
TO DIGITAL DISPLAY
TO FRONT PANEL CONTROL
TO A3J10 CALIBRATOR (SEE 13422 SHT. 4 & 4)
J7 CAL OUTPUT +10dBm/10mW
R1 75K CAL FACTOR-dB
R2 20K dB MANUAL REF
R3 10K dB OFFSET
M1 RELATIVE POWER (LINEAR MODES)
J6 INPUT RF DETECTOR
5V COM
15OL COM
THMS
PAD ID
LIN COMP
DETECTOR
DET. COM
C1 .01
LIST OF MATERIAL
NEXT ASSY
PACIFIC MEASUREMENTS INCORPORATED
RF POWER METER
MODEL 1045
13901
A
SHEET 1 OF 1


TO A8 INTERFACE #2
W2
REM
NOT USED
CAL FACTOR ON
.XXXX
X.XXX
µW
dB MODE
XX.XX
mW
0.1µW B
dBm B
10mW B
RANGE HOLD B
CAL B
CAL ON
AUTO ZERO B
TRIG AUTO REF B
MAN ZERO B
TRIG AUTO ZERO B
MAN dB B
SELF TRIG
10-20-40
4+B
E-RM
10+20+40
20+40
AUTO dB B
FIL B
DPM
DPM COM
AUTO LIN B
CHOPPER SYNC
1mW B
NOT USED
10 mW B
0.1 mW B
1 mW B
dBm/dB
REM
NEW DATA
AUTO CLK
dBm MODE
W
NOT USED
ANALOG OUTPUT
ANALOG COM
RATIO/MARKER IN
RF BLANKING
DET 4
DET 3
DET 2
DET 1
15V COM
+15V
-15V
+5V
5V COM
-15V ISOL
+15V ISOL
ISOL COM
W1
15V COM
15V COM
+5V
5V COM
+15V
+15V
+5V
5V COM
-15V
-15V
+5V
5V COM
-15V ISOL
+15V ISOL
15V ISOL COM
TO A4 POWER SUPPLY
S2 TRIGGER
EXT
INT
J4 EXT INPUT
HOT USED
J5 ANALOG OUTPUT
J3 RATIO/MARKER INPUT
RF BLANKING OUTPUT
J1
A3 DISPLAY LOGIC & CAL
J2
A11 IEEE INTERFACE
J3
A11 IEEE INTERFACE
J9 TP709
J8 TP708
W3
SEG TEST
.01
.08
.04
.02
.1
.8
.4
.2
1
8
4
2
10
40
20
dBm/dB
"+"
NEW DATA
5V COM
+5V
TO A5 FRONT PANEL & DISPLAY CKT
ASSEMBLY 13B11
REFERENCE DESIGNATORS ARE ABBREVIATED WITH PREFIX A7
LIST OF MATERIAL
NEXT ASSY
V.Y.I.
1-11-78
PACIFIC MEASUREMENTS INCORPORATED
INTERFACE #1
14069
A
SHEET 1 OF 1

TO AT INTERFACE #1
W2
W4
W5
J4
A1 CONTROL LOGIC & AMPL
J5
A1 CONTROL LOGIC & AMPL
J6
A2 ANALOG & PREAMP
J7
A12 MULTI-DETECTOR
J12
OPTION 01
TO A5 FRONT PANEL & DISPLAY CKT
ISOL COM
ASSEMBLY 13B13
REFERENCE DESIGNATOR ARE ABBREVIATED WITH PREFIX AB
LIST OF MATERIAL
PACIFIC MEASUREMENTS INCORPORATED
INTERFACE #2
14070
SHEET 1 OF 1

SYM	REVISION	ECO	DATE



ITEM	REQD	PART NO	DESCRIPTION

LIST OF MATERIAL

NEXT ASSY

FINISH OR TREATMENT

UNLESS OTHERWISE INDICATED DIMENSIONS ARE IN INCHES
TOLERANCE
XX ± .015
XXX ± .005

SCALE

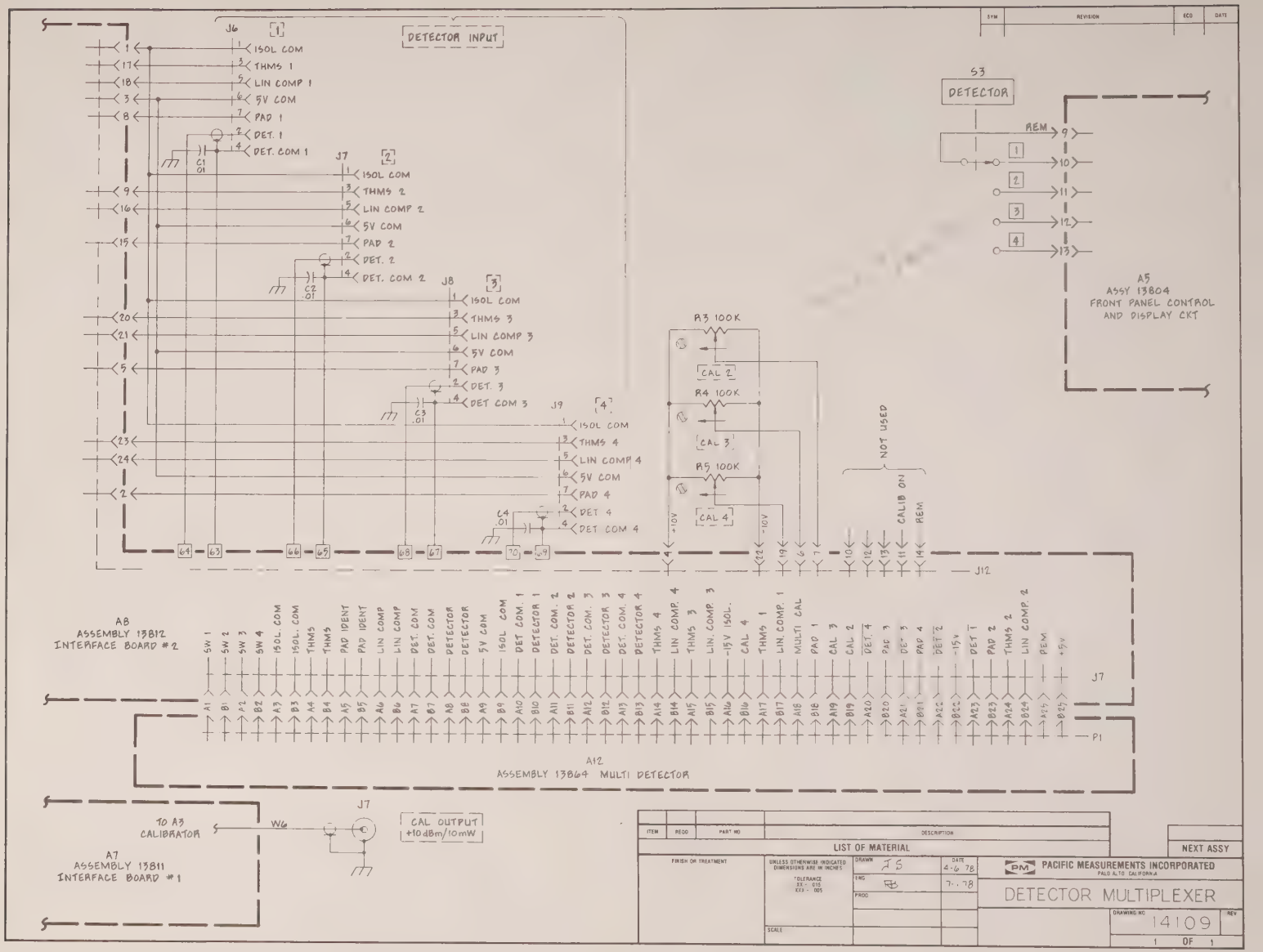
DRAWN DAN WATSON 4-26-78
ENG FB 7-11-78
PROD

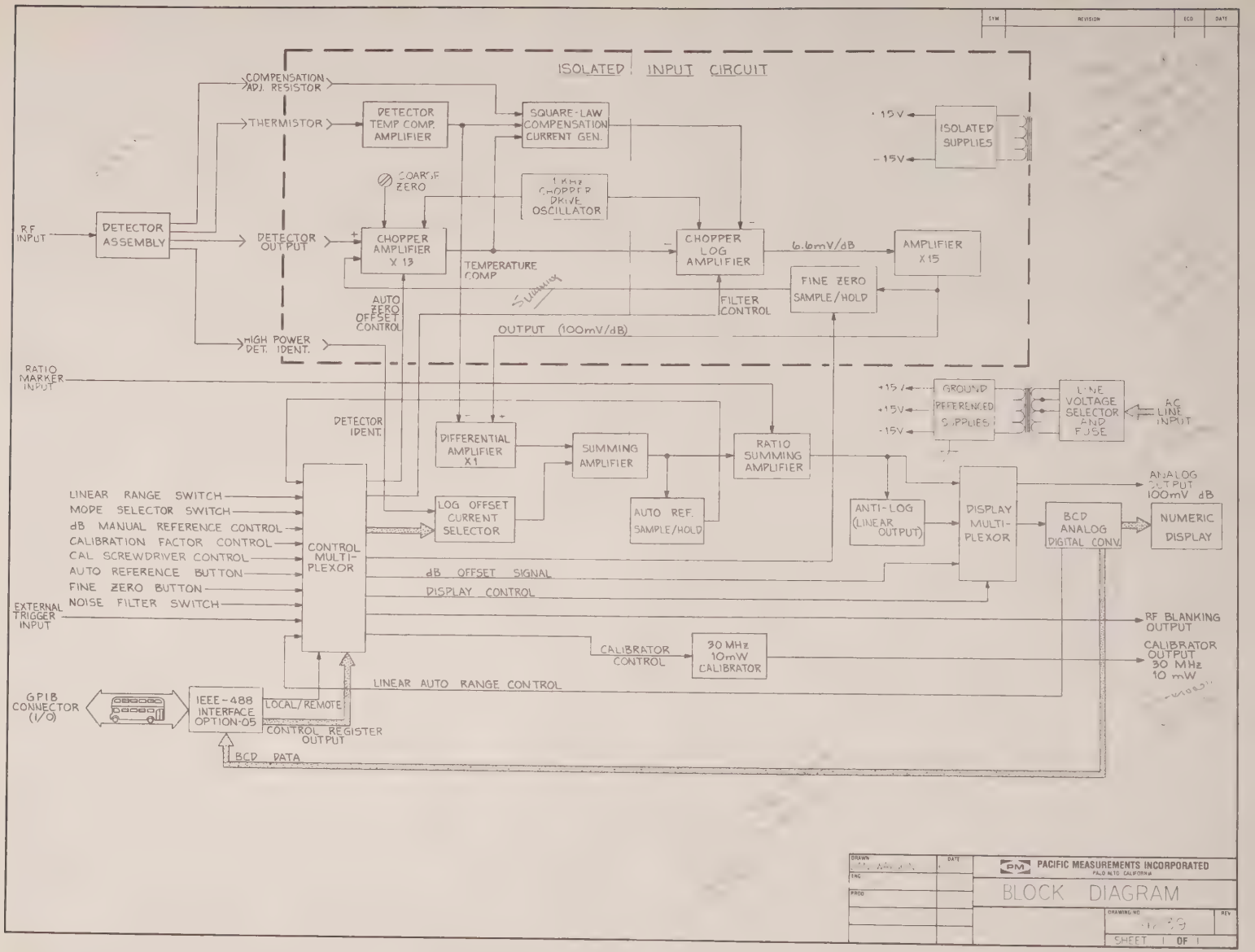
PACIFIC MEASUREMENTS INCORPORATED
PALO ALTO, CALIFORNIA

IEEE INTERFACE BUS

DRAWING NO 14099 REV

SHEET 1 OF 1


DETECTOR INPUT
J6
ISOL COM
THMS 1
LIN COMP 1
5V COM
PAD 1
DET. 1
DET. COM 1
J7
ISOL COM
THMS 2
LIN COMP 2
5V COM
PAD 2
DET. 2
DET. COM 2
J8
ISOL COM
THMS 3
LIN COMP 3
5V COM
PAD 3
DET. 3
DET COM 3
J9
ISOL COM
THMS 4
LIN COMP 4
5V COM
PAD 4
DET 4
DET COM 4
C1 .01
C2 .01
C3 .01
C4 .01
R3 100K
R4 100K
R5 100K
CAL 2
CAL 3
CAL 4
-10V
NOT USED
CALIB ON
REM
J12
S3
DETECTOR
REM
A5
ASSY 13804
FRONT PANEL CONTROL
AND DISPLAY CKT
A8
ASSEMBLY 13812
INTERFACE BOARD #2
SW 1
SW 2
SW 3
SW 4
ISOL. COM
THMS
PAD IDENT
LIN COMP
DET. COM
DETECTOR
5V COM
DET COM 1
DETECTOR 1
DET. COM. 2
DETECTOR 2
DET. COM. 3
DETECTOR 3
DET. COM. 4
DETECTOR 4
LIN COMP. 4
THMS 3
LIN. COMP 3
-15V ISOL.
CAL 4
THMS 1
LIN. COMP. 1
MULTI CAL
PAD 1
CAL 3
CAL 2
DET 4
PAD 3
DET 3
PAD 4
DET 2
-15V
DET 1
PAD 2
THMS 2
LIN COMP. 2
REM
+5V
J7
P1
A12
ASSEMBLY 13864 MULTI DETECTOR
10 A3
CALIBRATOR
W6
J7
CAL OUTPUT
+10 dBm/10mW
A7
ASSEMBLY 13811
INTERFACE BOARD #1
SYM
REVISION
ECO
DATE
ITEM
REQD
PART NO
DESCRIPTION
LIST OF MATERIAL
NEXT ASSY
FINISH OR TREATMENT
UNLESS OTHERWISE INDICATED DIMENSIONS ARE IN INCHES
TOLERANCE
XX - .010
XXX - .005
DRAWN
DATE
4-6-78
ENG
7-1-78
PROD
SCALE
PACIFIC MEASUREMENTS INCORPORATED
PALO ALTO, CALIFORNIA
DETECTOR MULTIPLEXER
DRAWING NO
14109
REV
1 OF 1


SYM
REVISION
ECO
DATE
ISOLATED INPUT CIRCUIT
COMPENSATION ADJ. RESISTOR
THERMISTOR
DETECTOR TEMP COMP. AMPLIFIER
SQUARE-LAW COMPENSATION CURRENT GEN.
+15V
-15V
ISOLATED SUPPLIES
COARSE ZERO
1 KHz CHOPPER DRIVE OSCILLATOR
R.F INPUT
DETECTOR ASSEMBLY
DETECTOR OUTPUT
CHOPPER AMPLIFIER X 13
CHOPPER LOG AMPLIFIER
6.6mV/dB
AMPLIFIER X15
TEMPERATURE COMP
FINE ZERO SAMPLE/HOLD
FILTER CONTROL
AUTO ZERO OFFSET CONTROL
OUTPUT (100mV/dB)
HIGH POWER DET. IDENT.
RATIO MARKER INPUT
+15V
+15V
-15V
GROUND REFERENCED SUPPLIES
LINE VOLTAGE SELECTOR AND FUSE
AC LINE INPUT
DETECTOR IDENT.
DIFFERENTIAL AMPLIFIER X1
SUMMING AMPLIFIER
RATIO SUMMING AMPLIFIER
ANALOG OUTPUT 100mV dB
LINEAR RANGE SWITCH
MODE SELECTOR SWITCH
dB MANUAL REFERENCE CONTROL
CALIBRATION FACTOR CONTROL
CAL SCREWDRIVER CONTROL
AUTO REFERENCE BUTTON
FINE ZERO BUTTON
NOISE FILTER SWITCH
CONTROL MULTI-PLEXOR
LOG OFFSET CURRENT SELECTOR
AUTO REF. SAMPLE/HOLD
ANTI-LOG (LINEAR OUTPUT)
DISPLAY MULTI-PLEXOR
BCD ANALOG DIGITAL CONV.
NUMERIC DISPLAY
dB OFFSET SIGNAL
DISPLAY CONTROL
EXTERNAL TRIGGER INPUT
RF BLANKING OUTPUT
CALIBRATOR OUTPUT 30 MHz 10 mW
CALIBRATOR CONTROL
30 MHz 10mW CALIBRATOR
LINEAR AUTO RANGE CONTROL
GPIB CONNECTOR (I/O)
IEEE-488 INTERFACE OPTION-05
LOCAL/REMOTE
CONTROL REGISTER OUTPUT
BCD DATA
DRAWN
DATE
ENG
PROD
PACIFIC MEASUREMENTS INCORPORATED
PALO ALTO CALIFORNIA
BLOCK DIAGRAM
DRAWING NO
REV
SHEET 1 OF 1

FEDERAL SUPPLY CODE FOR MANUFACTURERS

The following five-digit code numbers are listed in numerical sequence along with the manufacturer's name and address to which the code has been assigned.

The Federal Supply Code has been taken from Cataloging Handbook H 4-2, Code to Name.

00303 Shelly Associates Inc.
El Segundo, California

00656 Aerovox Corp.
New Bedford, Massachusetts

00779 AMP Inc.
Harrisburg, Pennsylvania

01002 General Electric Co.
Capacitor Dept.
Hudson Falls, New York

01121 Allen-Bradley Co.
Milwaukee, Wisconsin

01295 Texas Instruments, Inc.
Semiconductor Components Div.
Dallas, Texas

01961 Pulse Engineering Inc.
Santa Clara, California

02114 Ferroxcube Corp. of America
Saugerties, New York

02660 Amphenol-Borg Elect. Corp.
Broadview, Illinois

02735 Radio Corp. of America
Semiconductor and Materials Div.
Somerville, New Jersey

04062 Elmenco Products Co.
New York, New York

04713 Motorola, Inc.
Semiconductor Products Div.
Phoenix, Arizona

05035 Ayer Manufacturing Co.
Chicago Heights, Illinois

05245 Corcom Inc.
Chicago, Illinois

07126 Digitran Co.
Pasadena, California

07263 Fairchild Camera and Inst. Corp.
Semiconductor Div.
Mountain View, California

07910 Continental Device Corp.
Hawthorne, California

09214 General Electric Co.
Semiconductor Products Dept.
Auburn, New York

09353 C and K Components Inc.
Newton, Massachusetts

11332 General Microwave Corp.
Farmingdale, New York

11711 General Instruments Inc.
Semiconductor Div.
Newark, New Jersey

12674 Syncro Corp.
Hicksville, Ohio

12954 Dickson Electronics Corp.
Scottsdale, Arizona

14298 American Components, Inc.
Conshohocken, Pennsylvania

16733 Cablewave Systems
North Haven, Connecticut

17540 Alpha Industries
Woburn, Massachusetts

17856 Siliconix Inc.
Santa Clara, California

18235 KRL Electronics, Inc.
Manchester, New Hampshire

18324 Signetics Corp.
Sunnyvale, California

19447 Electro-Technique Inc.
Oceanside, California

21847 Aertech Industries
Sunnyvale, California

22045 Jordan Electric Co.
Van Nuys, California

22526 Berg Electronics Corp.
York Expressway
New Cumberland, Pennsylvania

24546 Corning Glass Works Electronic
Components Div.
Raleigh, North Carolina

24931 Speciality Connector Co. Inc.
Indianapolis, Indiana

25088 Siemens America Corp.
Iselin, New Jersey

27014 National Semiconductor Corp.
Santa Clara, California

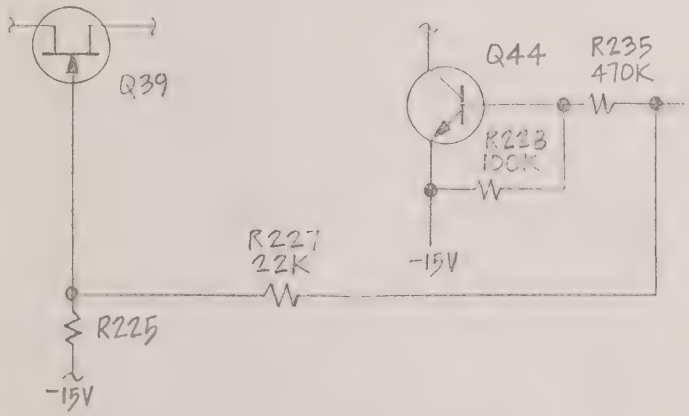
27556	IMB Electronic Products Santa Fe Springs, California
28480	Hewlett-Packard Co. Palo Alto, California
28821	Pacific Measurements Inc. Palo Alto, California
31918	International Electro Exchange Eden Prairie, Minnesota
32284	Rotron Manufacturing Co. Inc. Woodstock, New York
33025	Omni Spectra Tempe, Arizona
34078	Midwest Microwave Inc. Ann Arbor, Michigan
44655	Ohmite Mfg. Co. Skokie, Illinois
50625	Revere Corp. of America Wallingford, Connecticut
56289	Sprague Electric Co. North Adams, Massachusetts
70903	Belden Mfg. Co. Chicago, Illinois
71034	Bliley Electric Co. Erie, Pennsylvania
71400	Bussman Mfg. Div. of McGraw-Edison Co. St. Louis, Missouri
71450	CTS Corp. Elkhart, Indiana
71590	Centralab Electronics Milwaukee, Wisconsin
72982	Erie Tech. Products Inc. Erie, Pennsylvania
73138	Beckman Instruments Inc. Helipot Division Fullerton, California
73445	Amperex Electronic Corp. Hicksville, New York
74970	E.F. Johnson Co. Waseca, Minnesota
75915	Littlefuse Inc. Des Plaines, Illinois
76493	J.W. Miller Co. Compton, California
76541	Monsanto Commercial Products Co. Cupertino, California
76854	Oak Mfg. Co. Crystal Lake, Illinois
79727	Continental-Wirt Electronics Corp. Philadelphia, Pennsylvania
80031	Mepco/Electra Inc. A North American Phillips Co. Morristown, New Jersey
80294	Bourns Inc. Trimpot Div. Riverside, California
81073	Grayhill Inc. La Grange, Illinois
81095	Traid Transformer Corp. Venice, California
81483	International Rectifier Corp. El Segundo, California
82389	Switchcraft Inc. Chicago, Illinois
83330	H.H. Smith Inc. Brooklyn, New York
83594	Burroughs Corp. Electronic Components Div. Plainfield, New Jersey
83701	Electronic Devices Inc. Yonkers, New York
84171	Arco Electronics Inc. Great Neck, New York
90303	Mallory Battery Co. Tarrytown, New York
90634	Saft America Inc. Metuchen, New Jersey
91418	Radio Materials Co. Chicago, Illinois
91637	Dale Electronics Inc. Columbus, Nebraska
91929	Honeywell Inc. Microswitch Div. Freeport, Illinois
94144	Raytheon Co. Components Div. Quincy, Massachusetts
94222	Southco Inc. Lester, Pennsylvania
95146	Alco Electronics Lawrence, Massachusetts
99392	STM Corp. Oakland, California
99800	Delavan Electronics Corp. East Aurora, New York

MODEL 1045
MANUAL CORRECTIONS

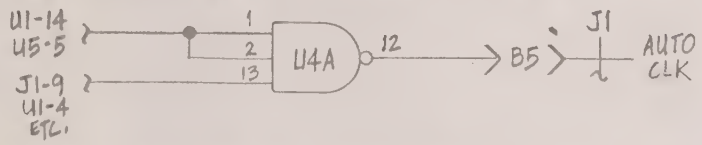
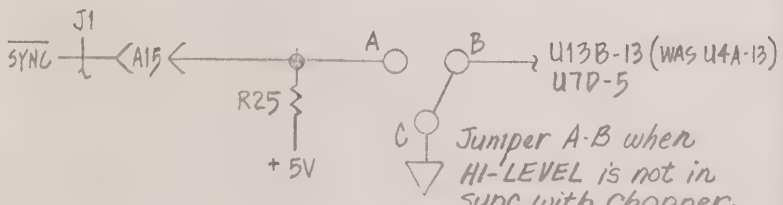
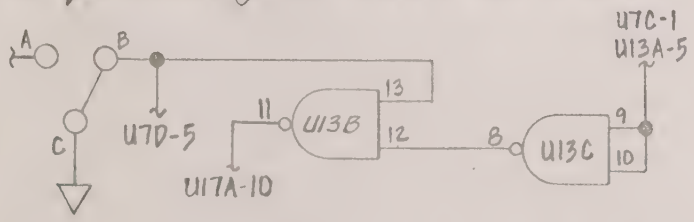
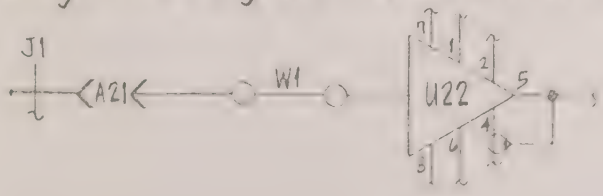
ODE NO.	CORRECTION	PM PART NO.	SECTION O MANUAL AFFECTE
02	CONTROL BOARD (Cont.)		
	5) Remove A1R84 1MΩ (10013-61)	———	8, 9
	6) Remove A1Q26 E112 (12591)	———	8, 9
	7) Change A1Q23 from 2N4119 (14132) to E112	12591	8, 9
	8) Schematic Diagram 13456 sht. 3 of 3 Replace 13456 sht. 3 of 3 with attach schematic diagram.	———	8
	a) A1C8 Tant. from 47 µF (10787-9) to 1.0 µF	10787-5	9
	b) A1C11 Tant. from 1.0 µF (10787-5) to .47 µF	10787-3	9
	c) A1C12 Tant. from .47 µF (10787-8) to 1.0 µF	10787-5	9
	d) Remove A1C9 47 µF (10787-9)	———	9
	e) A1C14 from 68 µF (10787-4) to 150 pF	10001-15	9
	f) A1R84 from 1MΩ (10013-61) to 470Ω	10013-21	9
	g) Remove A1R87 4.7KΩ (10013-33)		9
	h) Remove A1R88 62K (10013-83)		9
	i) A1R89 from 47KΩ (10013-45) to 100KΩ	10013-49	9
	j) A1R90 from 150KΩ (10013-51) to 100KΩ	10015-13	9
	k) A1R93 from 10KΩ (10013-37) to 4.7KΩ	10013-33	9
	l) A1R97 from 470KΩ (10013-21) to 120KΩ	10013-50	9
	m) Remove A1R98 100KΩ (10013-49)		9
	n) Remove A1R117 10KΩ (10013-37)		9
	o) Remove A1Q25 2N3569 (10017)		9
	p) Remove A1CR7 1N4148 (10043)		9
	q) Change A1U24 from SN74LS221N (13470-18) to SN74121N	11270-24	9

MODEL 1045
MANUAL CORRECTIONS

CODE NO.	CORRECTION	PM PART NO.	SECTION OF MANUAL AFFECTED
02	ANALOG AND PREAMP		
	1) Remove A2Q54 2N3565 (10019)	———	8, 9
	2) Remove A2Q55 E109 (12799)	———	8, 9
	3) Remove A2R258 4.7KΩ (10013-33)	———	8, 9
	4) Remove A2R259 220KΩ (10013-53)	———	8, 9
	5) Circuit change: Connect A2U16C pin 3 to A2Q43-D, A2J22, etc.	———	8
	6) Change circuitry on sheet 4 of 4:		



MODEL 1045
MANUAL CORRECTIONS

CODE NO.	CORRECTION	PM PART NO.	SECTION OF MANUAL AFFECTED
	DISPLAY LOGIC & CALIBRATOR		
02,03	1) Remove A3S1 (12430)	———	8, 9
02	2) Change circuitry on 13422 sht. 1 of 4 : 		8
02,03	3) Change circuitry on 13422 sht. 2 of 4 : 		8
02,03	4) Change circuitry on 13422 sht. 2 of 4 : 		8
02,03	5) Change circuitry on 13422 sht. 3 of 4 : 		8

MODEL 1045
MANUAL CORRECTIONS

ODE NO.	CORRECTION	PM PART NO.	SECTION OF MANUAL AFFECTED
02	POWER SUPPLY 1) Remove Test Points A4J2 thru A4J8 (10140-X)	———	8,9

SECTION 10

MANUAL CORRECTIONS

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CODE NO.	CORRECTIONS	PM PART NO.	SECTION OF MANUAL AFFECTED
ALL	Typographical Errors		
	1) Change Table 1-2, Option 02 from: Compatible with the APC-3.5, connector on detector 13840, but..... to: Compatible with the APC-7 connector on detector 13787, but.....		1
	2) Add to Table 1-2, Option 03 Compatible with APC-3.5 connector on detector 13840, but does not include coupling nut.		1
	3) Change para. 3.4.b to read: Calibrate the Model 1045. Connect the RF detector input to the CAL OUTPUT connector. For Option 01 select DETECTOR INPUT #1. Set the MODE switch (6) to CAL and with a screwdriver, adjust (19) for a reading of +10.00dBm on the display. Disconnect the cable from the CAL OUTPUT connector. For Option 01, select each of the other detectors to be used in turn and adjust the appropriate FINE CAL adjustment on the rear panel for a reading of +10.00dBm.		3
	4) Change para 3.4.e from: Set the FINE ZERO ADJUSTMENT to: Set the FINE ZERO. from: .....about 3-4 seconds. to: .....about 4 seconds.		3
	5) Change para 3.4.f to read: Making an RF POWER MEASUREMENT. Connect the RF detector, or, if Option 01, detectors to the RF power source, or sources. Select the mode.....		3

SECTION 10

MANUAL CORRECTIONS

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CODE NO.	CORRECTIONS	PM PART NO.	SECTION OF MANUAL AFFECTED
ALL	6) Add to para. 4.3.a.1: If the unit has Option 01, select DETECTOR #1 and connect the RF detector to DETECTOR INPUT #1.		4
	7) Change para. 5.2 (2nd paragraph in right-column) from: .....from less than 0.09μV to greater than an equivalent input of 90V. to: .....from less than 90μV to greater than an equivalent input of 90V.		5
	8) Change para. 6.3.1.d from: .....as shown with 0.01% resistors. to: .....as shown with 0.1% resistors.		6
	9) Add new paragraph, para. 6.3.1.h to read: If the unit has Option 01, Calibration Fixture PM part #14372.		6
	10) Add to para 6.3.2.c from: ANALOG (Board A2) to: ANALOG (Board A2) If the unit has Option 01, remove the Multi Detector Board A12 and replace it with the Calibration Fixture PM part #14372 and use DETECTOR #1 input.		6
	11) Add new paragraph, para. 6.3.2.c.46 to read: If the unit has Option 01, remove the Calibration Fixture PM part #14372 and replace the Multi Detector Board A12.		6

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MANUAL CORRECTIONS

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CODE NO.	CORRECTIONS	PM PART NO.	SECTION OF MANUAL AFFECTED
ALL	12) Change para. 6.4. from: .....to the CALIBRATOR OUTPUT and the CAL control set so the meter reads full-scale. to: .....to the CALIBRATOR OUTPUT and the CAL control set for a reading of 10.00dBm.		6
	13) Change para. 7.2 (page 7-2, 1st paragraph) from: To allow adjustment of MAN to COARSE ZERO control,..... to: To allow adjustment of COARSE ZERO control, ...		7
	14) Change para. 7.7 (page 7-4) from: 470 PRINT "FRONT PANEL IS ACTIVE." to: 470 PRINT "FRONT PANEL IS ACTIVE, PRESS RETURN TO CONTINUE."		
	15) Add to para. 7.7 (page 7-4) to read: 475 INPUT A$		7
	16) Change para. 7.7 (page 7-4) from: 480 GO TO 220 to: 480 GO TO 150		7
	17) Schematic Diagram, Control Board 13456 sht. 1 of 4 a) Change AUTO RANGE (sht. 4) to $\overline{\text{AUTO RANGE}}$ (sht. 4) b) Change MAN Ø (sht. 3) (U10C-8, etc.) to $\overline{\text{MAN Ø}}$ (sht. 3)		8

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CODE NO.	CORRECTIONS	PM PART NO.	SECTION OF MANUAL AFFECTED
ALL	18) Schematic Diagram, Analog Board 13510		8
	a) Remove A2R246. A2U16C-3 connects to A2R259 and Q55-D.		
	19) Add to Chassis Assy 13900:		
	a) J7 (Part of W6 RF Cable Assy 14047)		9
	b) R2 should read R2/R3		9
	20) Add to Display Logic.....Assembly 13421:		
	a) A3S1 DPDT	12430	9
	21) Add Multi-Det. Pot-Connector P.C. Board Assy 14290:		
	a) A13C1, A13C2, A13C3 & A13C4 ceramic .01μF	10000-11	9
	b) A13J6, A13J7, A13J8 & A13J9 7 cont. recept.	13257	9
	c) A13R3 A13R4 & A13R5 Variable 100KΩ	11676-1	9
	d) A13W1 cable, 24 pin DIP	14291-1	9
	22) Add Multi-Det Multiplexer Assy 14108:		
	a) S1 Switch Assy	14335	9
	b) Calibrate Fixture P.C. Board	14372	9
	23) Change Multi-Detector PC Board Assy 13864		
	a) A12R14 thru A12R17 from 10KΩ (10013-37) to 150KΩ	10013-51	8,9
	b) A12R42 thru A12R45 from 470Ω (10013-21) to 1.8KΩ	10013-28	8,9

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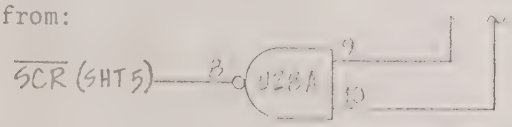
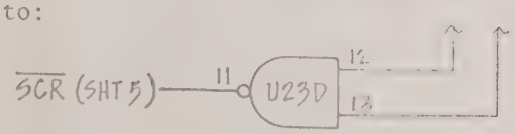
CODE NO.	CORRECTIONS	PM PART NO.	SECTION OF MANUAL AFFECTED
ALL	24) Change Analog PC Board Assy 13509		
	a) A2R96 from 1.2MΩ (10013-98) to 348KΩ 1%	10015-109	8,9
	b) A2R102 from 154KΩ 1%)10015-26 to 464KΩ 1%	10015-6	8,9
	c) A2R108 from 78.7KΩ 1% (10015-185) to 80.6KΩ 1%	10015-183	8,9
	d) A2R109 from 162KΩ 1% (10015-34) to 243KΩ 1%	10015-184	8,9
	25) Change Control PC Board Assy 13455		
	a) A11C11 from 1μF (10787-5 to .47μF	10787-8	9
	b) A1C12 from .47μF (10787-8) to 1μF	10787-5	9
	26) Change Ref Designator on Schematic Diagram 13422 (sheet 3):		8
	a) U23A - pin 4 to R28 should read R39, 33Ω		
	27) Change IEEE Interface Schematic Diagram 13660 (sheet 1 of 5): from:  to:  		
	28) Change Table 1-3 (page 1-5) from:.....<-50dB, return loss >30dB to:.....<-50dB, return loss <25dB		

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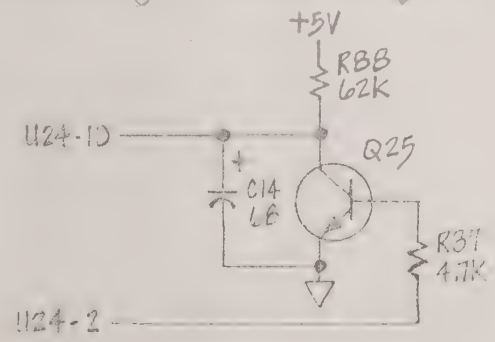
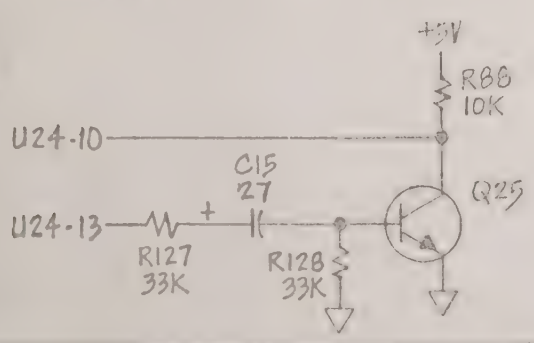
CODE NO.	CORRECTIONS	PM PART NO.	SECTION OF MANUAL AFFECTED
03	[illegible]		
	Change A2C52 and A2C53 from .01 μF (10000-11) to 0.1 μF	[illegible]	[illegible]
	Change Type of Variable Res. A2R216 from 10046-11 to 20 Turn Variable Res.	[illegible]	[illegible]
	Change A2R94 from [illegible]	[illegible]	[illegible]
	Display Ckt		
	Change A3R16 from 374KΩ (10015-14) to 3.31K	[illegible]	[illegible]
	Change [illegible] from 23.7Ω (10015-231) to 150Ω	[illegible]	[illegible]
	Change A3C11 from 1.0 μF [illegible] to 0.1 μF	[illegible]	[illegible]
	Control Ckt		
	Make the following circuit change:		
	From		



To



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CODE NO.	CORRECTIONS	PM PART NO.	SECTION OF MANUAL AFFECTED
03	Control CKT (cont.)		
	Remove A1A87 4.7KΩ		
	Remove A1C14		
	Change A1R83 from		
	to 2K		
	Add A1C15 Cap., Tantalum		
	Add A1A127 and A1A128		
	Change A1C8 from .1 M		
	to .68 uf		
	Change A1Q23 circuit from		
	pin 4 to 15V com. to		
	to U23 pin 2.		

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CODE NO.	CORRECTIONS	PM PART NO.	SECTION OF MANUAL AFFECTED
04	Control Board		
	1) Change A1R55 from 470KΩ (10013-57) to 316KΩ	10015-14	8,9
	2) Change A1R83 from 50KΩ (10046-3) to 100KΩ	10046-10	8,9

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